Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability

2004 Addendum

October 2004

U.S. Environmental Protection Agency
Region III
Chesapeake Bay Program Office
Annapolis, Maryland

and

Region III
Water Protection Division
Philadelphia, Pennsylvania

in coordination with

Office of Water
Office of Science and Technology
Washington, D.C.

Contents

Acknowledgments

This addendum to the October 2003 *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability* was developed and documented through the collaborative efforts of the members of the Chesapeake Bay Program's Water Quality Standards Coordinators Team: Richard Batiuk, U.S. EPA Region III Chesapeake Bay Program Office; Joe Beaman, Maryland Department of the Environment; Gregory Hope, District of Columbia Department of Health; Libby Chatfield, West Virginia Environmental Quality Board; Tiffany Crawford, U.S. EPA Region III Water Protection Division; Elleanore Daub, Virginia Department of Environmental Quality; Lisa Huff, U.S. EPA Office of Water; Wayne Jackson, U.S. EPA Region II; James Keating, U.S. EPA Office of Water; Robert Koroncai, U.S. EPA Region III Water Protection Division; Benita Moore, Pennsylvania Department of Environmental Protection; Shah Nawaz, District of Columbia Department of Health; Scott Stoner, New York State Department of Environmental Conservation; David Wolanski, Delaware Department of Natural Resources and Environmental Control; and Carol Young, Pennsylvania Department of Environmental Protection.

The individual and collective contributions from members of the Chesapeake Bay Program Office and NOAA Chesapeake Bay Office staff are also acknowledged: Ricky Bahner, Interstate Commission on the Potomac River Basin/Chesapeake Bay Program Office; David Jasinski, University of Maryland Center for Environmental Science/Chesapeake Bay Program Office; Marcia Olson, NOAA Chesapeake Bay Office; Gary Shenk, U.S. EPA Region III Chesapeake Bay Program Office; and Howard Weinberg, University of Maryland Center for Environmental Science/Chesapeake Bay Program Office.

chapter i

Introduction

In October 2003, the U.S. Environmental Protection Agency (EPA) published the *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability (Technical Support Document)* in cooperation with and on behalf of the six watershed states—New York, Pennsylvania, Maryland, Delaware, Virginia and West Virginia—and the District of Columbia. Developed as a companion document to the *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries*, the *Technical Support Document* was the direct result of the collective contributions of hundreds of regional economists, technical modelers and analysts, stakeholders and agency managers.

At the time of publication of the *Technical Support Document,* a number of technical designated use and attainability issues still remained to be worked through, resolved and documented. The Chesapeake Bay Water Quality Standards Coordinators Team—water quality standards program managers and coordinators from the seven Chesapeake Bay watershed jurisdictions and EPA's Office of Water, Region 2 and Region 3—took on the responsibility on behalf of the Chesapeake Bay watershed partners to collectively work through these technical issues. The work on these issues was largely in support of the four jurisdictions with Bay tidal waters who were formally adopting the published Chesapeake Bay water quality criteria, designated uses and criteria attainment procedures into their states' water quality standards regulations.

This EPA published addendum to the 2003 *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability* provides expanded designated use related documentation for the following issues and designated uses:

- Documentation on refinements to Chesapeake Bay tidal water designated use boundaries for the western lower Chesapeake Bay, Rappahannock River, Elizabeth River and Patapsco River (Chapter 2).
- Documentation for the Chesapeake Bay Program segmentation scheme boundary delineations (Chapter 3).

- Documentation for the boundaries between the three jurisdictions along the tidal Potomac River (Chapter 4).
- Expanded documentation on the Chesapeake Bay submerged aquatic vegetation (SAV) no-grow zones (Chapter 5).
- Updated data and expanded documentation on the Chesapeake Bay SAV restoration goal, shallow-water habitat and shallow-water existing use acreages (Chapter 6).
- Detailed narrative descriptions and latitude/longitude coordinates delineating the migratory, open-water, deep-water and deep-channel designated use boundaries (Appendix A).

Through publication by EPA, as a formal addendum to the 2003 Chesapeake Bay *Technical Support Document,* this document should be viewed by readers as supplemental chapters and appendices to the original published *Technical Support Document*.

chapter ii

Refinements to Chesapeake Bay Tidal Water Designated Use Boundaries

Upon adoption of the nutrient and sediment cap load allocations by major tributary basins by jurisdiction in April 2003 (Secretary Murphy 2003), the watershed partners had additional information and tools to both confirm the published designated uses (U.S. EPA 2003) and refine specific use boundaries in selected regions of the Chesapeake Bay and its tidal tributaries. A series of summer (June–September) month by month density/pycnocline boundaries/dissolved oxygen concentrations depth profiles were generated for 1985–1994 (hydrodynamic years of the Chesapeake Bay water quality model output). Both the observed (actual monitored water quality conditions 1985–1994) and Chesapeake Bay water quality model simulated water quality (1985–1994 hydrologic conditions) upon achievement of the cap load allocations were generated for over 150 individual Chesapeake Bay Water Quality Monitoring Program stations. An example of the literal thousands of generated profiles is provided in Figure II-1.

Based on this information made available to the Chesapeake Bay watershed partners after the October 2003 EPA publication of the *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability (Technical Support Document)* (U.S. EPA 2003), refinements to the published open-water, deep-water and/or deep-channel designated use boundaries in the western lower Chesapeake Bay, Rappahannock River, Elizabeth River and Patapsco River have been documented below. For the remaining Chesapeake Bay and tidal tributary waters, the detailed evaluation of the summer months density/pycnocline boundaries/dissolved oxygen concentrations depth profiles confirmed the attainability and validity of the EPA published open-water, deep-water and deep-channel designated use boundaries.

The recommended refined Chesapeake Bay tidal water designated use boundary delineations for open-water, deep-water and deep-channel designated uses are illustrated in Figure II-2. No changes were recommended to the migratory spawning and nursery designated use boundaries published in U.S. EPA 2003. Extensive documen-

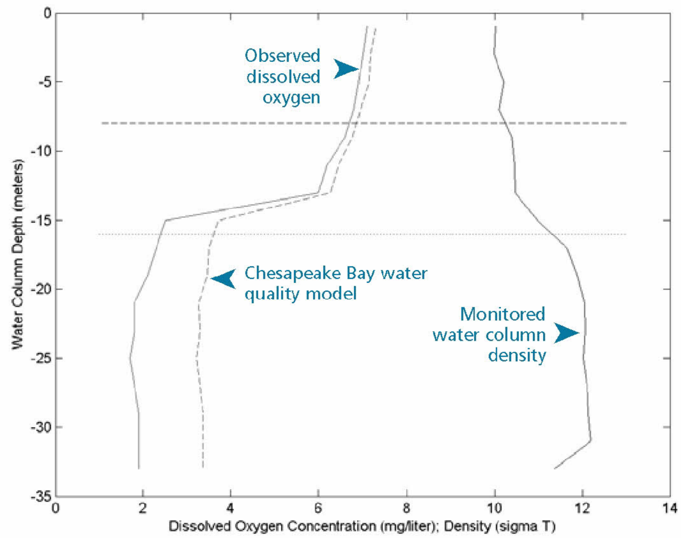

Figure II-1. Example of the summer (June-September) month by month density/-pycnocline boundaries and dissolved oxygen concentrations depth profiles generated for 1985-1994. Monitored water column density and observed dissolved oxygen concentrations with depth are illustrated alongside the Chesapeake Bay water quality model simulated dissolved oxygen concentration depth profile under basinwide achievement of the nutrient and sediment cap load allocations at station CB5.4 in the middle Chesapeake Bay mainstem on August 19, 1985.

Source: Chesapeake Bay Water Quality Monitoring and Modeling Programs
http://www.chesapeakebay.net/data

tation of the recommended migratory spawning and nursery, open-water, deep-water and deep-channel designated uses boundaries—narrative text descriptions and latitude/longitude coordinates—is contained in Appendix A. Recommended refinements to the shallow-water bay grass designated use boundaries are documented in Chapter 6.

WESTERN LOWER CHESAPEAKE BAY

Based on water quality model estimates, achievement of the established nutrient and sediment cap load allocations basinwide would result in just over 1 percent non-attainment in the western lower Chesapeake Bay, also referred to as segment CB6PH (Figure II-3; Table II-1). This level of model-estimated non-attainment was based on the designated use boundaries previously published by EPA in the *Technical Support Document* (U.S. EPA 2003). Virginia representatives expressed a desire to determine a refined southern boundary between the open-water/deep-water and open-water throughout the entire water column designated uses whereby the estimated level of dissolved oxygen criteria non-attainment would fall below 1 percent. This level of

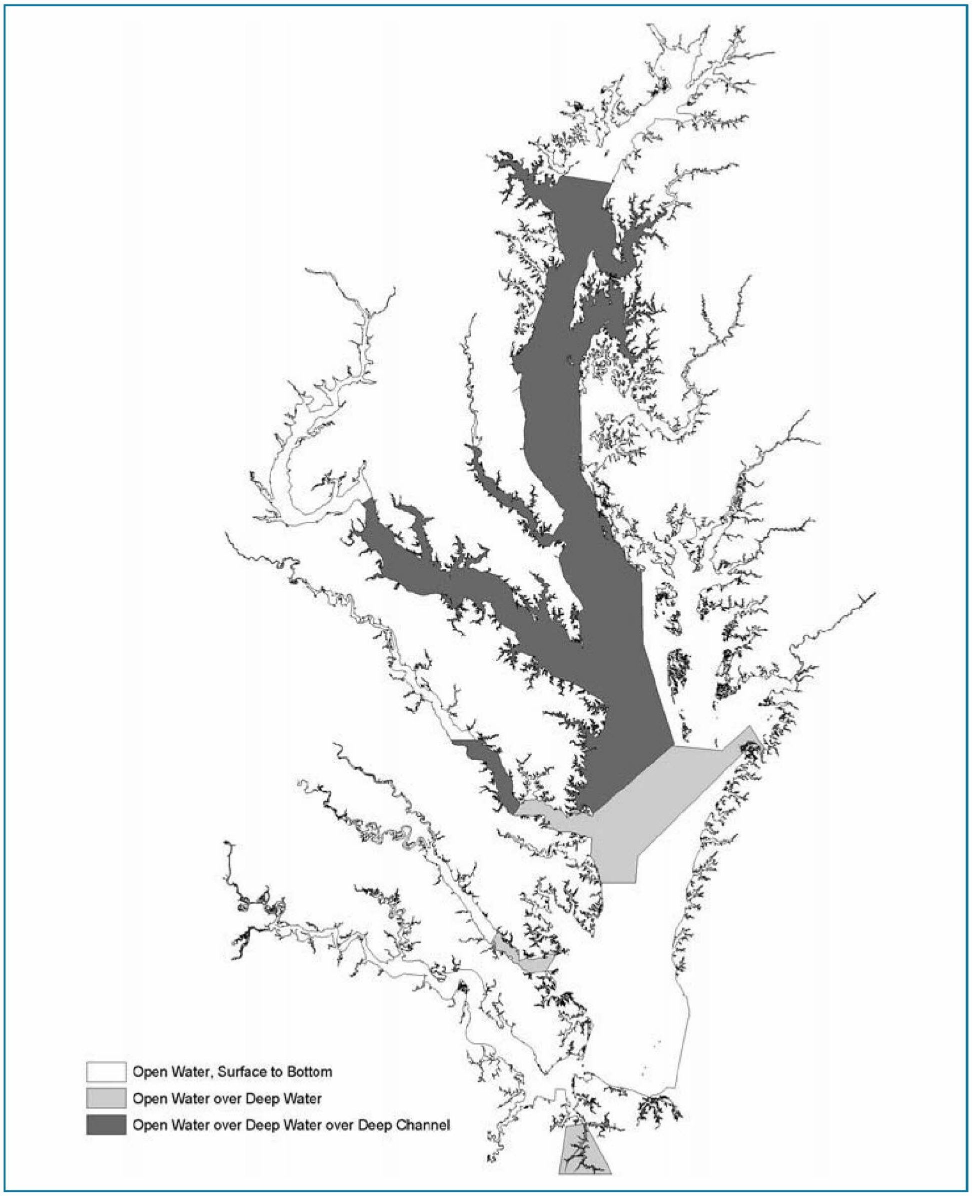

Figure II-2. Map illustrating the refined geographic distribution of the open-water fish and shellfish, deep-water seasonal fish and shellfish and deep-channel seasonal refuge designated uses across Chesapeake Bay and its tidal tributaries.

non-attainment is consistent with the water quality model estimated very low levels of remaining percent dissolved oxygen criteria non-attainment in a number of other Chesapeake Bay Program segments—see segments CB2OH, CB3MH, CB5MH, CB7PH, PAXOH, POTOH, POTMH and EASMH in the "Confirmation" column in Table II-1.

The percent remaining dissolved oxygen criteria non-attainment in the segment CB6PH open-water designated use habitats was determined for incremental (1 kilometer) southward movements of the down-Bay boundary between the

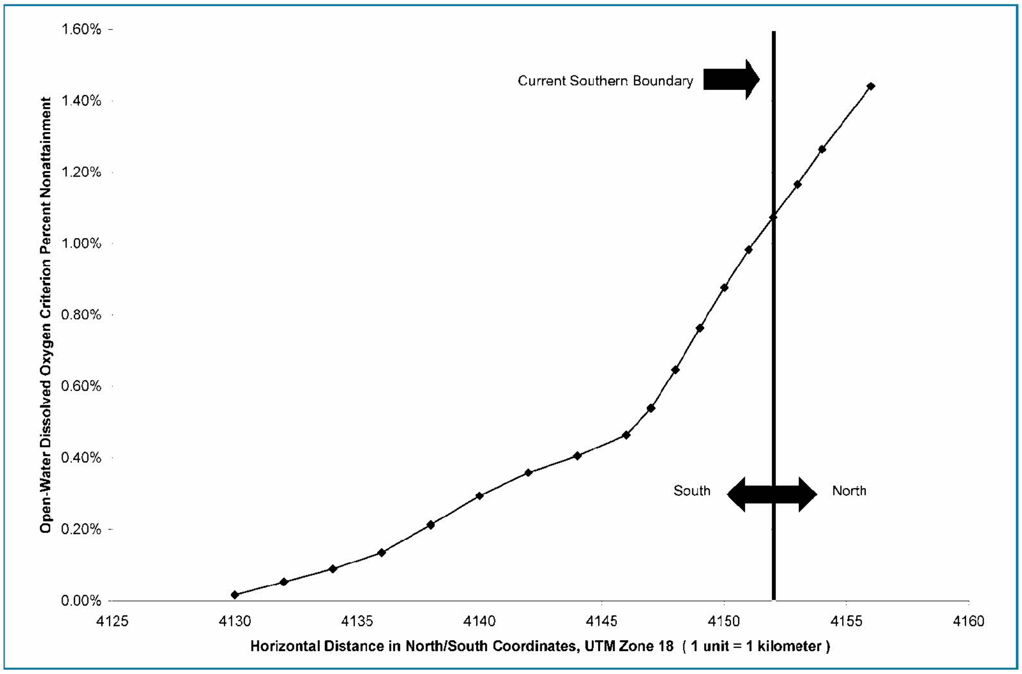

Figure II-3. Illustration of the Chesapeake Bay open-water dissolved oxygen criteria percent non-attainment within the lower western Chesapeake Bay, segment CB6PH, under model simulated summer (June-September) water quality conditions upon basinwide achievement of nutrient and sediment cap load allocations. Percent open-water dissolved oxygen criteria non-attainment estimates are provided at one kilometer increments north and south of the boundary between the open-water/deep-water and the open-water throughout the water column designated uses originally published in the October 2003 Technical Support Document.

Source: U.S. EPA 2003; Chesapeake Bay Modeling Program http://www.chesapeakebay.net/data

open-water/deep-water and open-water throughout the entire water column designated uses (Figure II-3). On the x-axis in Figure II-3, each 1 unit change in the Y coordinate equals one kilometer in horizontal distance. Southward movement of the southern CB6PH boundary between the open-water/deep-water and open-water throughout the entire water column designated uses yielded incrementally lower and lower dissolved oxygen criteria non-attainment percentages. A down-Bay movement of the designated uses boundary only 2 kilometers results in a percent dissolved oxygen criteria non-attainment of <0.85 percent. There is clearly a significant downward slope in the remaining non-attainment percentages from 4152 (location of the current southern boundary between the open-water/deep-water versus open-water throughout the entire water column designated uses) to 4145 (<0.4 percent) in Figure II-3. In this figure, 4145 is the location in the western lower Chesapeake Bay, adjacent to Milford Haven, Virginia, where the natural channel shallows out into a consistent bottom plain of depths averaging around 35 feet. Beyond this location, incremental decreases in percent dissolved oxygen criteria non-attainment tends to flatten out, with percent non-attainment under the basinwide cap load allocation achieved model scenario estimated water quality conditions eventually reaching zero at 4130 (a location adjacent to New Point Comfort at the northern entrance to Mobjack Bay) (Figure II-3).

Table II-1. Summer (June-September) dissolved oxygen criteria percent non-attainment by designated use by Chesapeake Bay Program segment for key Chesapeake Bay Water Quality Model scenarios based on the 1985-1994 hydrodynamic years.

Segment	DU	Observed	Progress 2000	Tier1	Tier2	Tier3	Allocation	Confirmation	E3
Northern Chesapeake Bay (CB1TF)	MIG	A	A	A	A	A	A	A	A
	OW	A	A	A	A	A	A	A	A
Upper Chesapeake Bay (CB2OH)	MIG	A	A	A	A	A	A	A	A
	OW	1.92	0.88	0.68	0.43	0.17	0.08	0.09	A
Upper Central Chesapeake Bay (CB3MH)	MIG	0.19	A	A	A	A	A	A	A
	OW	A	A	A	A	A	A	A	A
	DW	4.18	2.52	2.24	1.61	0.73	0.38	0.46	A
	DC	13.52	8.16	7.21	5.03	1.84	0.12	0.40	A
Middle Central Chesapeake Bay (CB4MH)	OW	0.05	A	A	A	A	A	A	A
	DW	19.64	15.28	14.28	12.05	8.51	5.96	6.99	0.69
	DC	45.19	32.75	28.94	18.81	3.93	1.02	1.75	A
Lower Central Chesapeake Bay (CB5MH)	OW	A	A	A	A	A	A	A	A
	DW	6.16	4.38	3.75	2.58	1.08	0.72	0.86	A
	DC	13.79	7.76	6.00	2.59	0.15	0.08	0.08	A
Western Lower Chesapeake Bay (CB6PH)	OW	5.87	4.26	3.68	2.71	1.30	0.97	1.13	0.01
	DW	0.36	0.01	A	A	A	A	A	A
Eastern Lower Chesapeake Bay (CB7PH)	OW	4.55	3.31	2.81	1.82	0.74	0.50	0.63	A
	DW	A	A	A	A	A	A	A	A
Mouth of the Chesapeake Bay (CB8PH)	OW	A	A	A	A	A	A	A	A
Upper Patuxent River (PAXTF)	MIG	A	A	A	A	A	A	A	A
	OW	A	A	A	A	A	A	A	0.38
Middle Patuxent River(PAXOH)	MIG	A	A	A	A	A	A	A	A
	OW	9.79	1.56	1.84	1.62	0.86	0.09	0.10	A
Lower Patuxent River (PAXMH)	MIG	A	A	A	A	A	A	A	A
	OW	7.40	1.59	1.69	1.04	0.01	A	A	A
	DW	5.52	0.85	0.82	0.50	0.07	A	A	A
Upper Potomac River (POTTF)	MIG	A	A	A	A	A	A	A	A
	OW	A	A	A	A	A	A	A	A
Middle Potomac River (POTOH)	MIG	A	A	A	A	A	A	A	A
	OW	2.10	1.36	1.08	0.63	0.31	0.18	0.20	0.01
Lower Potomac River (POTMH)	MIG	A	A	A	A	A	A	A	A
	OW	0.78	A	A	A	A	A	A	A
	DW	6.90	5.03	4.53	3.11	1.12	0.26	0.58	A
	DC	18.89	11.39	8.64	5.07	0.19	0.16	0.17	A
Upper Rappahannock River (RPPTF)	MIG	A	A	A	A	A	A	A	A
	OW	A	A	A	A	A	A	A	A
Middle Rappahannock River (RPPOH)	MIG	A	A	A	A	A	A	A	A
	OW	A	A	A	A	A	A	A	A
Lower Rappahanock River (RPPMH)	MIG	A	A	A	A	A	A	A	A
	OW	0.44	0.27	0.10	A	A	A	A	A
	DW	5.58	2.61	1.09	0.01	A	A	A	A
	DC	6.39	5.20	3.38	1.65	A	A	A	A
Piankatank River (PIAMH)	OW	0.12	A	A	A	A	A	A	A
Upper Mattaponi River (MPNTF)	MIG	A	A	A	A	A	A	A	A
	OW	33.42	27.37	25.87	27.23	33.73	34.44	38.05	52.14
Lower Mattaponi River (MPNOH)	MIG	A	A	A	1.72	2.78	1.34	2.12	6.08
	OW	46.93	31.00	28.95	31.86	28.99	24.17	28.21	48.11
Upper Pamunkey River (PMKTF)	MIG	A	A	A	A	A	A	A	0.10
	OW	62.25	49.53	42.07	30.35	32.94	21.77	32.47	54.50
Lower Pamunkey River (PMKOH)	MIG	A	A	A	A	A	A	A	A
	OW	42.15	15.22	12.66	13.86	10.32	4.92	9.55	11.39
Middle York River (YRKMH)	MIG	A	A	A	A	A	A	A	A
	OW	18.08	4.85	3.31	2.32	0.42	0.15	0.19	A
Lower York River (YRKPH)	OW	1.48	0.01	A	A	A	A	A	A
	DW	0.01	A	A	A	A	A	A	A
Mobjack Bay (MOBPH)	OW	2.30	1.78	1.60	1.10	0.34	0.25	0.30	A
Upper James River (JMSTF)	MIG	A	A	A	A	A	A	A	A
	OW	0.66	A	A	A	A	A	A	A
Middle James Rivery (JMSOH)	MIG	A	A	A	A	A	A	A	A
	OW	A	A	A	A	A	A	A	A
Lower James River (JMSMH)	MIG	A	A	A	A	A	A	A	A
	OW	A	A	A	A	A	A	A	A
Mouth of the James River (JMSPH)	OW	A	A	A	A	A	A	A	A

continued

Table II-1 continued. Summer (June-September) dissolved oxygen criteria percent non-attainment by designated use by Chesapeake Bay Program segment for key Chesapeake Bay Water Quality Model scenarios based on the 1985-1994 hydrodynamic years.

Eastern Bay (EASMH)	MIG	A	A	A	A	A	A	A	A
	OW	A	A	A	A	A	A	A	A
	DW	3.26	2.18	2.00	0.90	0.36	0.27	0.27	A
	DC	20.23	12.87	11.26	6.49	0.67	0.02	0.10	A
Middle Choptank River (CHOOH)	MIG	A	A	A	A	A	A	A	A
	OW	0.11	A	A	A	A	A	A	A
Mouth of the Choptank (CHOMH1)	MIG	A	A	A	A	A	A	A	A
	OW	2.27	1.83	1.78	1.51	1.08	0.78	0.92	0.43
Lower Choptank River (CHOMH2)	MIG	A	A	A	A	A	A	A	A
	OW	0.33	A	A	A	A	A	A	A
Tangier Sound (TANMH)	OW	0.15	0.06	0.06	0.05	0.36	0.31	0.33	0.22
Lower Potomac River (POCMH)	OW	A	A	A	A	A	A	A	A

KEY

DU: designated use.

Observed: 1985-1994 water quality monitoring data.

Progress 2000: model scenario simulating water quality conditions under BMPs and wastewater technology upgrades implemented as of 2000.

Tier 1: model scenario representing current level of implementation throughout the watershed plus existing regulatory requirements implemented through the year 2010.

Tier 2: model scenario representing the first intermediate level between the Tier 1 and E3 scenarios.

Tier 3: model scenario representing the second intermediate level between the Tier 1 and E3 scenarios.

Allocation: model scenario simulating the adopted basinwide nitrogen, phosphorus and sediment cap loads.

Confirm: model scenario simulating the adopted nitrogen, phosphorus and sediment cap loads allocated by major tributary basin by jurisdiction.

E3: model scenario simulating implementation levels at 'everything, everywhere by everybody' with no cost and few physical limitations

Based on this information made available to the Chesapeake Bay watershed partners after publication of the *Technical Support Document* (U.S. EPA 2003), the boundary between the open-water/deep-water and open-water use throughout the water column designated uses for the lower western Chesapeake Bay has been moved approximately 8 kilometers southward from the original October 2003 published boundary (Figure II-2). This refined boundary coincides with the location identified in Figure II-3 (4145) where reductions in percent dissolved oxygen criteria non-attainment flatten out with increasing distance as the natural channel shallows out into a consistent bottom plain.

RAPPAHANNOCK RIVER

In the *Technical Support Document*, the boundary between the open-water designated use throughout the water column and the open-water/deep-water/deep-channel designated uses in the mainstem Rappahannock River was drawn between Mulberry Point and Jenkins Landing, upriver of water quality monitoring station RET3.1 and just down river of station TF3.3 (U.S. EPA 2003). A more detailed evaluation of the summer months density/pycnocline boundaries/dissolved oxygen concentrations with updated observed and confirmation scenario water quality model generated depth profiles clearly indicated this boundary between the two sets of designated uses was drawn too far upriver.

Evaluation of the water quality monitoring data record at station RET3.1 revealed minimal to no water column stratification and only two observed bottom dissolved oxygen concentrations less than 5 mg $liter^{-1}$ over the 10 year data record (i.e., 1985–1994). The water quality monitoring record at station RET 3.2 indicated minimal to no water column stratification and only two of the 75 observed bottom dissolved oxygen concentrations were less than 4 mg $liter^{-1}$. Attainability of the open-water designated use throughout the water column in the reach of the Rappahannock River characterized by stations RET3.1 and RET3.2 was confirmed using the Chesapeake Bay water quality model confirmation scenario outputs estimating dissolved oxygen conditions throughout the water column under basinwide achievement of the allocated nutrient and sediment cap loads.

Under the 1985–1994 observed dissolved oxygen conditions recorded through the Chesapeake Bay Water Quality Monitoring Program, there is clearly non-attainment of the deep-water and deep-channel designated uses south of the current use boundary between the open-water throughout the water column and open-water/deep-water/deep-channel designated uses (Figure II-4). At the same time, the open-water designated use dissolved oxygen criteria non-attainment is less than 0.5 percent in the river reach from the current boundary between the designated uses down river to coordinate 4185, a location in the Rappahannock River down river of station RET3.2.

Under model estimated water quality conditions simulated under the basinwide cap load allocations achieved scenario, the open-water, deep-water and deep-channel designated uses dissolved oxygen criteria were estimated to be in full attainment down river to coordinate 4185 (Figure II-5). Further, application of the open-water designated use throughout the water column down to coordinate 4185 was estimated to yield full attainment under these water quality model simulated water quality conditions (Figure II-5). Moving the boundary for open-water throughout the water column further down-river beyond coordinate 4185 results in dissolved oxygen criteria non-attainment values climbing to over 1.3 percent within the next 15 kilometers, clearly indicating a distinct hydrodynamic/bottom bathymetry transition in this section of the river (Figure II-5).

Based on this information made available to the Chesapeake Bay watershed partners after publication of the *Technical Support Document* (U.S. EPA 2003), the recommended boundary between the open-water designated use throughout the water column and the open-water/deep-water/deep-channel designated uses in the Rappahannock River has been moved approximately 20 kilometers down river from the original published boundary. The refined boundary has been delineated just upriver of Jones Point on the southern shoreline then across the river to Farnham Creek on

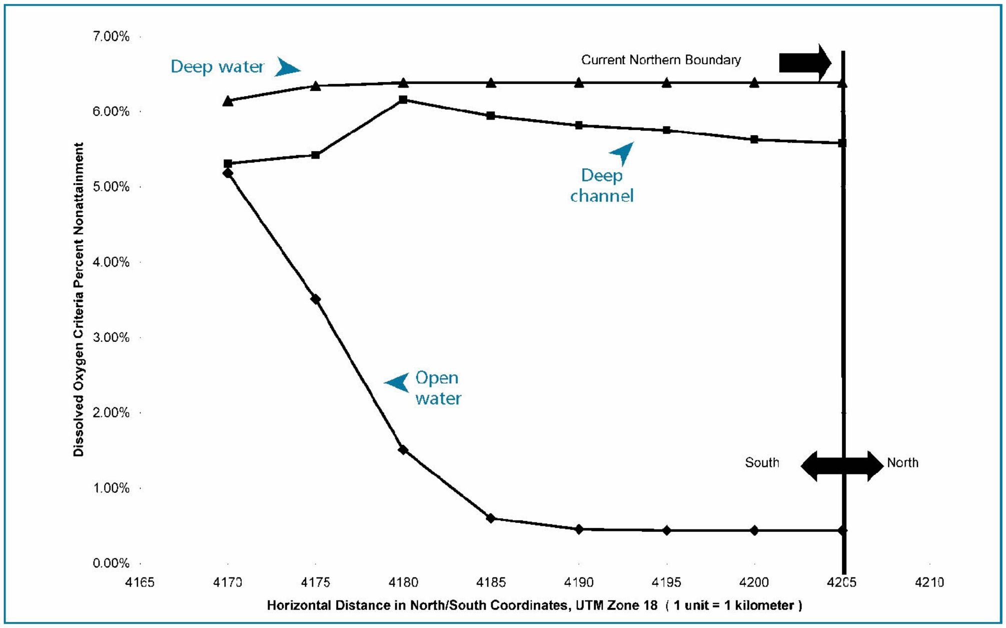

Figure II-4. Illustration of the Chesapeake Bay open-water dissolved oxygen criteria percent non-attainment within the lower Rappahannock River, segment RPPMH, under summer (June–September) 1985–-1994 water quality monitoring program observed conditions. Percent dissolved oxygen criteria non-attainment estimates for the applicable open-water, deep-water and deep-channel criteria are provided at five kilometer increments south of the boundary between the open-water/deep-water and the open-water throughout the water column designated uses originally published in the October 2003 Technical Support Document.
Source: U.S. EPA 2003; Chesapeake Bay Modeling Program http://www.chesapeakebay.net/data

the northern shoreline (see Figure II-2). This refined boundary coincides with the location identified in Figure II-5 as 4185 where full open-water dissolved oxygen criteria attainment transitions into increasing non-attainment with increasing distance down river. This location is just upriver of where the natural river channel begins to broaden and reach depths of greater than 30 feet, starting at Jones Point. These natural bathymetric features, in combination with the resultant water column stratification and hydrodynamic processes, further validate the application of the combined open-water/deep-water/deep-channel designated uses down river from this location.

ELIZABETH RIVER

Since publication of the *Technical Support Document*, the watershed partners generated and evaluated results from a series of analyses on measured ambient surface and bottom dissolved oxygen concentrations compared with oxygen saturation calculated concentrations. Depth profiles of observed density, pycnocline depth(s) and dissolved oxygen concentrations were also generated for all Elizabeth River water quality monitoring stations for each station's available water quality data record, but not for model estimated water quality conditions under basinwide achievement of the nutrient cap load allocations.

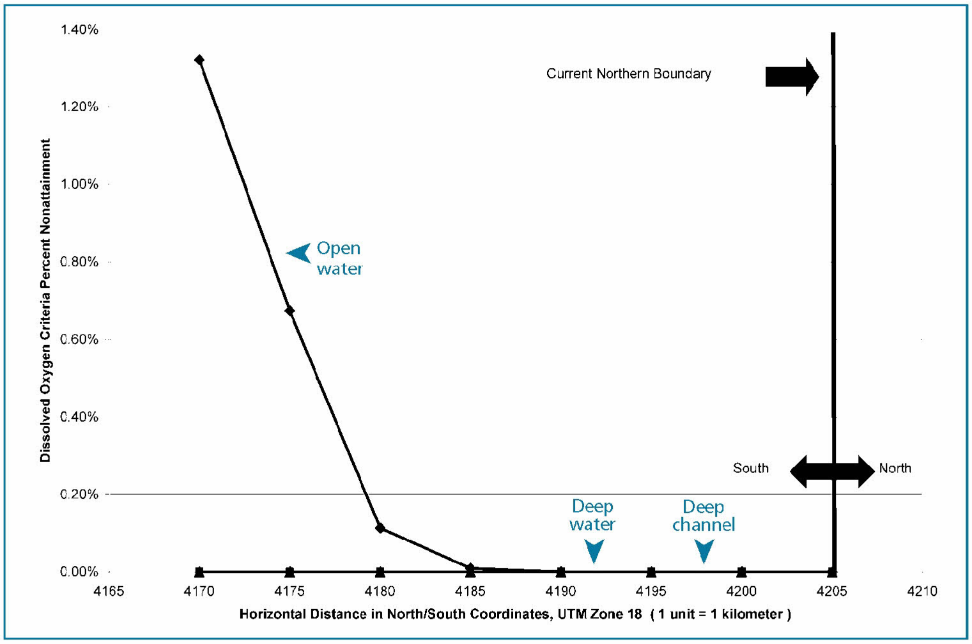

Figure II-5. Illustration of the Chesapeake Bay open-water dissolved oxygen criteria percent non-attainment within the lower Rappahannock River, segment RPPMH, under model simulated summer (June-September) water quality conditions upon basinwide achievement of nutrient and sediment cap load allocations. Percent dissolved oxygen criteria non-attainment estimates for the applicable open-water, deep-water and deep-channel criteria are provided at five kilometer increments south of the boundary between the open-water/deep-water and the open-water throughout the water column designated uses originally published in U.S. EPA (2003).

Sources: U.S. EPA 2003; Chesapeake Bay Water Quality Monitoring Program http://www.chesapeakebay.net/data

It must be noted that the current version of the Chesapeake Bay Water Quality Model does include cells required for simulation of water quality conditions within the tidal Elizabeth River. However, given the complexity of circulation patterns within the river, the limitations of the number of cells used to simulate the river, and the limited efforts to calibrate the model specifically for the Elizabeth River, the Chesapeake Bay Program's Modeling Subcommittee did not select any of the Elizabeth River's five segments for assessment of model calibration for management application (Linker et al. 2002). The Chesapeake Bay Program's Water Quality Steering Committee could not evaluate attainability of the designated uses within the Elizabeth River for this reason (U.S. EPA 2003). Therefore, the findings described here do not reflect model estimated water quality conditions upon achievement of the allocated nutrient and sediment cap loads for the five Elizabeth River segments. However, evaluation of water quality monitoring data records available from 23 water quality monitoring stations—ranging from 2 to 20 years of data—provided sufficient information to refine the recommended tidal water designated use boundaries for the Elizabeth River and its tidal tributaries.

MOUTH TO MID-ELIZABETH RIVER

In the mouth to mid-Elizabeth River, segment ELIPH, evaluation of the long term water quality monitoring record for the five stations within this segment indicated very few dissolved oxygen profiles with concentrations below the pycnocline (when present) below 5 mg liter^{-1}. Often there was no measurable pycnocline observed in the summer months. When a pycnocline was calculated, the water column stratification often had little to no effect on the vertical water column dissolved oxygen concentration gradient (less than a 1–2 mg liter^{-1} change over the 14 meter water column) (Figure II-6). As the channel extending out of the Elizabeth River makes a direct connection with the channel connecting the James River with the Atlantic Ocean via the Chesapeake Bay mouth, this results in the routine inflow of oxygenated water along the Bay bottom into this segment of the Elizabeth River.

The actual observed dissolved oxygen concentrations in this section of the river may also be affected by what tide the individual stations are sampled on. There is direct evidence in a number of depth profile plots where the bottom dissolved oxygen concentrations are higher than concentrations higher up in the water column as might happen on flood tide (higher dissolved oxygen concentration water coming into the Elizabeth River from the lower James/Atlantic Ocean) (Figure II-7).

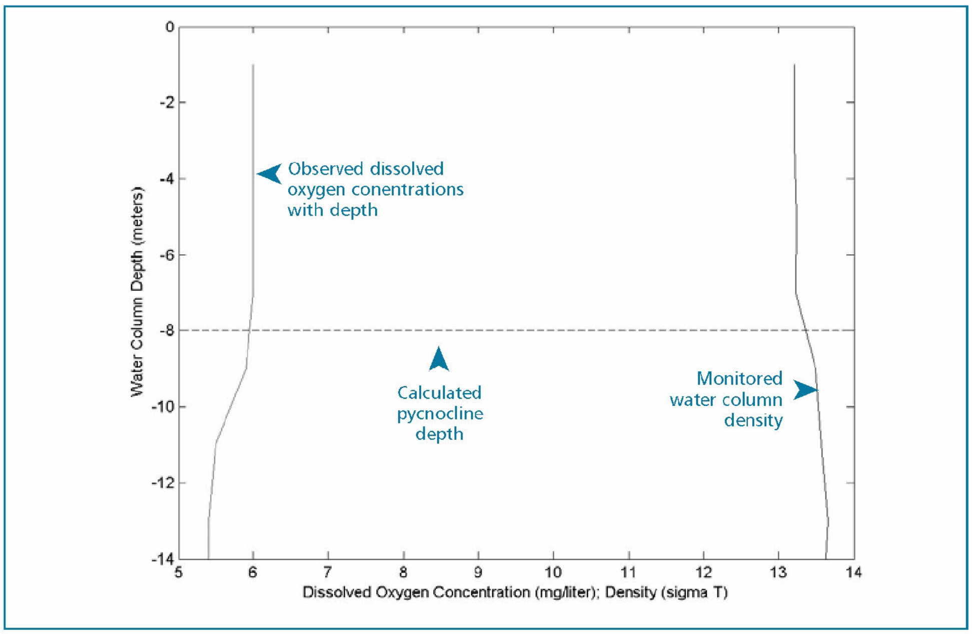

Figure II-6. Representative density and dissolved oxygen concentration depth profile for the mouth to mid-Elizabeth River, segment ELIPH. Monitored water column density, observed dissolved oxygen concentrations with depth and calculated pycnocline depth are illustrated for station LE5.6 for data collected on July 13, 1987.

Source: Chesapeake Bay Water Quality Monitoring Program http://www.chesapeakebay.net/data

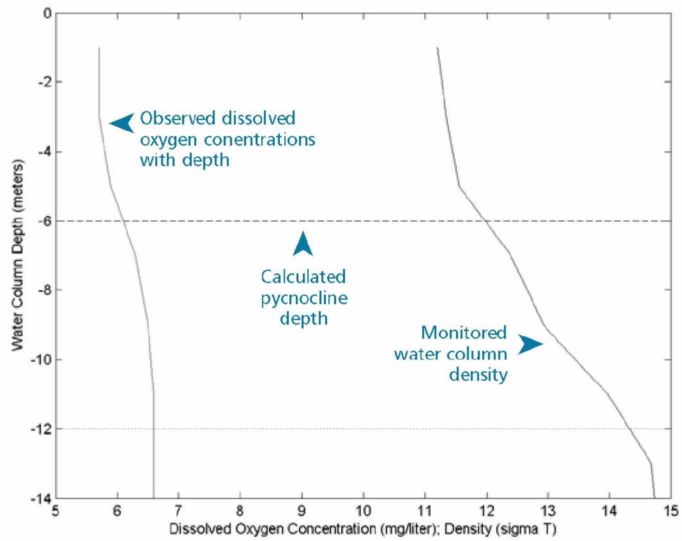

Figure II-7. Representative density and dissolved oxygen concentration depth profile for the mouth to mid-Elizabeth River, segment ELIPH. Monitored water column density, observed dissolved oxygen concentrations with depth, and calculated pycnocline depth are illustrated for station LE5.6 for data collected on July 13, 1987.

Source: Chesapeake Bay Water Quality Monitoring Program http://www.chesapeakebay.net/data

Finally, evaluation of calculated oxygen saturation concentrations in comparison with observed ambient dissolved oxygen concentration yielded the conclusion that caclulated oxygen saturation concentrations were well above the 5 mg liter^{-1} level. There is no indication that the open-water dissolved oxygen criteria could not be met in this segment strictly due to natural limitations (temperature, salinity) on oxygen saturation.

Given the information available at the time of publication of the *Technical Support Document*, an open-water/deep-water/deep channel set of designated uses was recommended for application in this segment (U.S. EPA 2003). Based on evaluation of the more extensive water quality monitoring record and analysis of oxygen saturation conditions, an open-water designated use extending throughout the water column is recommended for the mouth to mid-Elizabeth River segment (Figure II-2).

LAFAYETTE RIVER

The long term water quality monitoring record at two stations in the Lafayette River, segment LAFMH, indicated very few dissolved oxygen profiles with concentrations below the pycnocline (when present) below 5 mg liter^{-1}. This tidal river system has a very shallow water column (3–4 meters) with very limited to no evidence of water column stratification. The very well mixed water column throughout this tidal system is evidenced by the vertical density profiles (Figure II-8). There is no indication that the open-water dissolved oxygen criteria could not be met in this segment strictly due to natural limitations on oxygen saturation. These findings validate the recommended open-water designated use throughout the water column for the Lafayette River published in the *Technical Support Document* (U.S. EPA 2003).

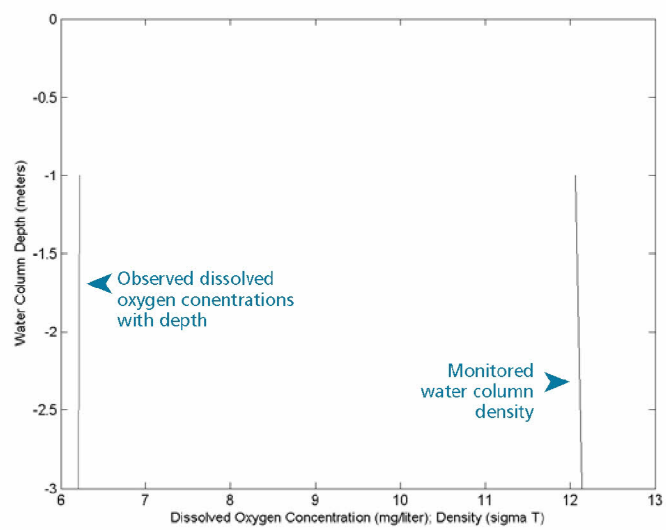

Figure II-8. Representative density and dissolved oxygen concentration depth profile for the Lafayette River, segment LAFMH. Monitored water column density and observed dissolved oxygen concentrations with depth are illustrated for station LFA01 for data collected on July 26, 2001.

Source: Chesapeake Bay Water Quality Monitoring Program http://www.chesapeakebay.net/data

WESTERN BRANCH ELIZABETH RIVER

In the Western Branch Elizabeth River, segment WBEMH, the long term water quality monitoring record at two stations indicates almost no water column stratification within a very shallow water column (3-5 meters). Top to bottom differences in water column dissolved oxygen concentrations were almost always 1 mg $liter^{-1}$ or less, with infrequent bottom dissolved oxygen concentrations below 5 mg $liter^{-1}$ (Figure II-9). There is no indication that the open-water dissolved oxygen criteria could not be met in this segment strictly due to natural limitations on oxygen saturation. These findings validate the recommended open-water designated use throughout the water column for the Western Branch Elizabeth River published in the *Technical Support Document* (U.S. EPA 2003).

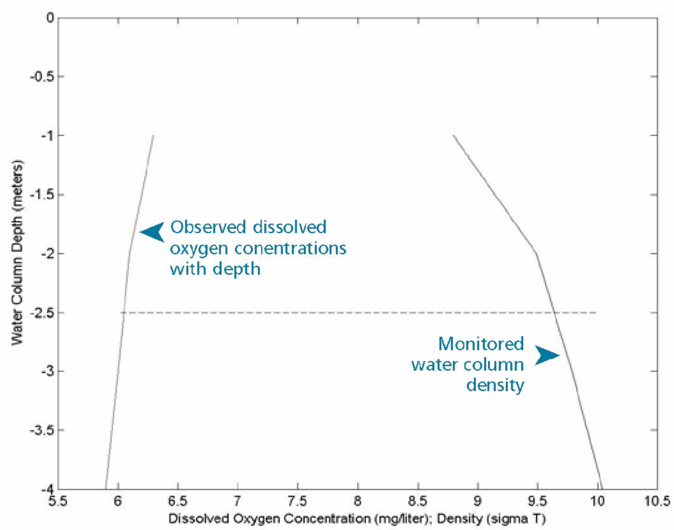

Figure II-9. Representative density and dissolved oxygen concentration depth profile for the Western Branch Elizabeth River, segment WBEMH. Monitored water column density and observed dissolved oxygen concentrations with depth are illustrated for station WBE1 on August 20, 1996.

Source: Chesapeake Bay Water Quality Monitoring Program http://www.chesapeakebay.net/data

EASTERN BRANCH ELIZABETH RIVER

The water quality monitoring record for four stations in the Eastern Branch Elizabeth River, segment EBEMH, documented infrequent water column stratification (defined as when pycnocline boundaries can be delineated). There is clear evidence of a more frequent number of dissolved oxygen profiles with concentrations below 5 mg liter^{-1} compared to stations in the mouth to mid-Elizabeth River segment. However, the presence or absence of a measurable pycnocline does not impact the observed dissolved oxygen water column profile. About half the dissolved oxygen profiles have a surface versus bottom difference of 1 mg liter^{-1} or less; majority of the remaining profiles have a difference of up to 2 mg liter^{-1} (Figure II-10). There were several recorded profiles (3 of 55) with 3-4 mg liter^{-1} differences between surface and bottom water dissolved oxygen concentrations. Application of a deep-water designated use would not work on this segment given: 1) lack of water column stratification influence on water column dissolved oxygen; and 2) frequent, clear evidence of concentrations of 5 mg liter^{-1} and above throughout the water column. Factoring in the unquantified dissolved oxygen concentration improvements expected upon achievement of the nutrient cap loads allocated to the encompassing James River basin, these findings validate the recommended open-water designated use throughout the water column for this segment published in the *Technical Support Document* (U.S. EPA 2003).

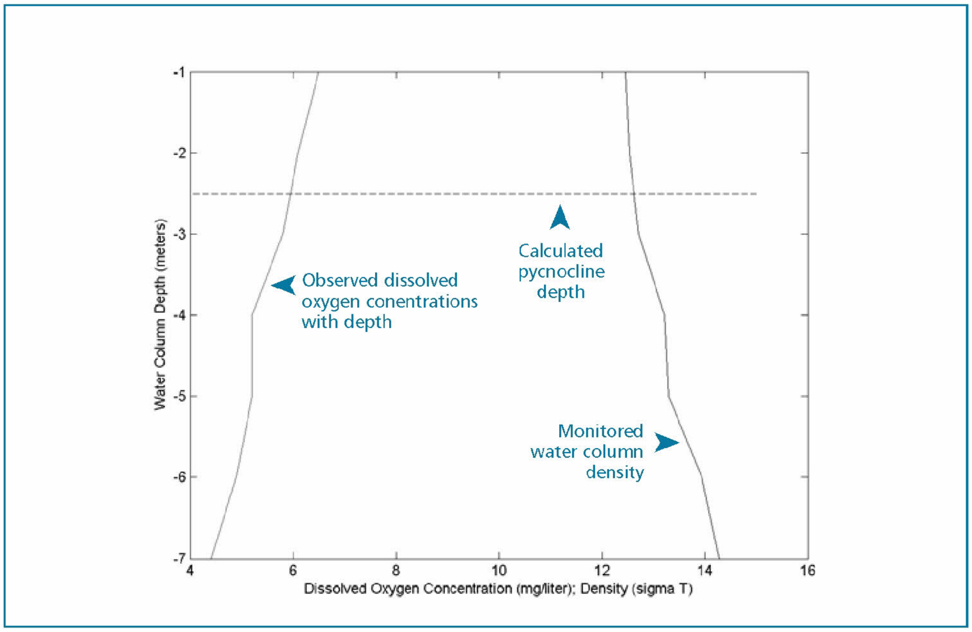

Figure II-10. Representative density and dissolved oxygen concentration depth profile for the Eastern Branch Elizabeth River, segment EBEMH. Monitored water column density for data collected, observed dissolved oxygen concentrations with depth and calculated pycnocline depth are illustrated for station EBE1 for data collected on August 11, 1993.
Source: Chesapeake Bay Water Quality Monitoring Program http://www.chesapeakebay.net/data

SOUTHERN BRANCH ELIZABETH RIVER

The long term water quality monitoring record synthesized from nine different stations in the Southern Branch Elizabeth River, segment SBEMH, indicates stronger and more frequent water column stratification and clear evidence of a more frequent number of dissolved oxygen profiles with concentrations below 5 mg liter^{-1} compared with the adjacent upriver mouth to mid-Elizabeth River segment. However, the extent of influence of the water column stratification on the observed water column profile dissolved oxygen concentration is questionable. The relationship was strongest at station SBE2 but even at that station there were often dates where the change in dissolved oxygen from top to bottom is 1 mg liter^{-1} or less with a calculated pycnocline present (Figure II-11). These findings call into question strict application of open-water/deep-water uses and application of the respective applicable dissolved oxygen criteria. Consideration should be given to derivation of a segment specific set of dissolved oxygen criteria reflecting the significant level of anthropogenic modification of the Southern Branch Elizabeth River.

PATAPSCO RIVER

A open-water/deep-water/deep-channel designated use was recommended for the Patapsco River (segment PATMH) in the *Technical Support Document* (U.S. EPA 2003b). Further analysis by the Maryland Department of the Environment, using a

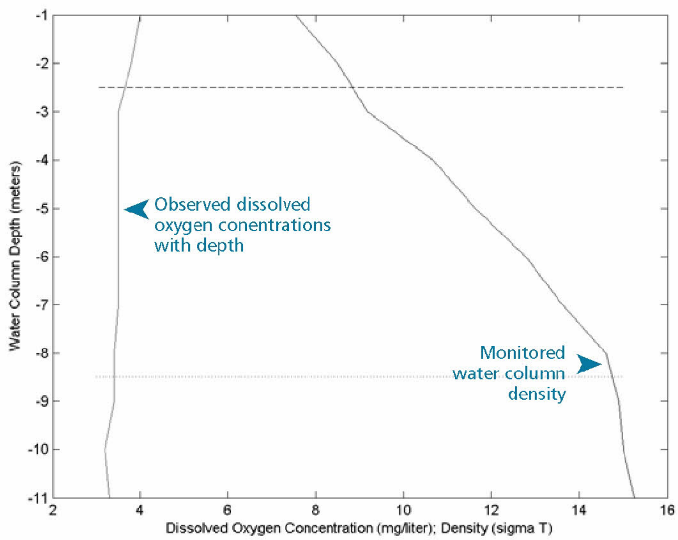

Figure II-11. Representative density and dissolved oxygen concentration depth profile for the Southern Branch Elizabeth River, segment SBEMH. Monitored water column density and observed dissolved oxygen concentrations with depth are illustrated for station SBE2 on July 23, 1993.

Source: Chesapeake Bay Water Quality Monitoring Program http://www.chesapeakebay.net/data

tidal water quality model specific to the Patapsco River, yielded results indicating that the dissolved oxygen criteria for the deep water (30-day mean 3.2 mg liter^{-1} applied June 1 to September 30), and the deep channel (instantaneous minimum 1.0 mg liter^{-1}, applied June 1 to September 30) could not be met. Even after simulating implementation of limit of technology nitrogen reductions from point sources (3 mg liter^{-1} total nitrogen effluent concentration) and achievement of the nutrient cap loads allocated to the Patapsco basin, Maryland's water quality model estimated a 4 percent non-attainment of the deep-water designated use dissolved oxygen criteria and a 72 percent non-attainment of the deep-channel designated use criteria (Beaman 2004). The dissolved oxygen criteria for the open-water designated use, which also applies in both of the aforementioned areas from October 1 to May 31, was projected to be attained under the same load reductions.

Starting back in the 1830, the tidal Patapsco River has been dredged at yearly to decadal frequencies for the past 170 years. The existing benthic community in the Patapsco Rivers' dredged navigation channels can be characterized as unstable due to frequent disturbances such as annual maintenance dredging and prop-wash/displacement associated with commercial vessel movement, and is thought to consist primarily of opportunistic species. Opportunistic species tend to be pollution tolerant and are able to readily recolonize disturbed habitats. The benthic community, likely to recolonize the dredged channels after such repeated physical disturbances, would be similar in nature to the existing benthic community.

As stated in the *Technical Support Document,* the deep-channel designated use was defined as protecting "the survival of balanced, indigenous populations of ecologically important benthic infaunal and epifaunal worms and clams, which provide food for bottom-feeding fish and crabs." An instantaneous minimum dissolved oxygen criterion of 1mg liter^{-1} was determined to be protective of this designated use (U.S. EPA 2003a).

Given the deep-channel designated use dissolved oxygen criteria can not be attained and the unique, routine physical disturbance of these dredged channel habitats, a navigation channel use is recommended to apply from June 1 to September 30 in place of a deep-channel use in the Patapsco River. The navigational channel use will protect opportunistic species that are tolerant of or have behaviorally adapted to routine habitat disturbance caused by shipping and dredging activities and/or tolerant or have behaviorally adapted to frequent sustained periods of minimal or no dissolved oxygen due to seasonal stratification of the water column between June 1 and September 30.

CHESAPEAKE BAY AND TIDAL TRIBUTARIES DESIGNATED USE BOUNDARY DOCUMENTATION

Appendix A contains detailed narrative descriptions and latitude/longitude coordinates delineating the boundaries for the open-water fish and shellfish, deep-water fish and shellfish and deep-channel seasonal refuge designated uses illustrated in Figure II-2. Detailed documentation for the migratory spawning and nursery designated use boundaries, originally published in U.S. EPA 2003, is also provided in Appendix A.

LITERATURE CITED

Beaman, Joseph. 2004. June 2, 2004. Personal communication/unpublished documentation. Maryland Department of the Environment, Baltimore, Maryland.

Linker, L.C., G.W. Shenk, P. Wang, C.F. Cerco, A.J. Butt, P.J. Tango and R.W. Savidge. 2002. *A Companion of Chesapeake Bay Estuary Model Calibration with 1985–1994 Observed Data and Method Application to Water Quality Criteria.* Modeling Subcommittee, Chesapeake Bay Program Office, Annapolis, Maryland

Secretary Tayloe Murphy. 2003. "Summary of Decisions Regarding Nutrient and Sediment Load Allocations and New Submerged Aquatic Vegetation (SAV) Restoration Goals." April 25, 3003, Memorandum to the Principals' Staff Committee members and representatives of the Chesapeake Bay headwater states. Virginia Office of the Governor, Natural Resources Secretariate, Richmond, Virginia.

U.S. Environmental Protection Agency. 2003. *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability.* EPA 903-R-03-004. Region III Chesapeake Bay Program Office, Annapolis, Maryland.

chapter iii
Chesapeake Bay Program Segmentation Scheme Boundary Delineations

For the last 20 years, the Chesapeake Bay Program partners have used various forms of a basic segmentation scheme to organize the collection, analysis and presentation of environmental data. The *Chesapeake Bay Program Segmentation Scheme: Revision, decisions, and rationales* provides documentation on the development of the spatial segmentation scheme of the Chesapeake Bay and its tidal tributaries and the later revisions and changes over the last 20 years (Chesapeake Bay Program 2004). The document contains information on the 1983–1985 original segmentation, the 1997–1998 revisions for the 1997 Re-evaluation, and the 2003 segmentation corrections and expansion. This chapter provides a concise summary on the segmentation scheme background and a listing of the principal contents of the larger segmentation document related to tidal water designated uses.[1]

CHESAPEAKE BAY PROGRAM SEGMENTATION SCHEMES

NEED FOR A SEGMENTATION SCHEME

Segmentation is the compartmentalizing of the estuary into subunits based on selected criteria. The Chesapeake Bay ecosystem is diverse and complex, and the physical and chemical factors which vary throughout the Bay determine the biological communities and affect the kind and extent of their response to pollution stress. These same factors also influence their response to restoration and remediation. For diagnosing anthropogenic impacts, segmentation is a way to group regions having similar natural characteristics, so that differences in water quality and biological communities among similar segments can be identified and their source elucidated. For management purposes, segmentation is a way to group similar regions to define a range of water quality and resource objectives, target specific actions and monitor response. It provides a meaningful way to summarize and present information in parallel with these objectives, and it is a useful geographic pointer for data management.

[1]The entire Chesapeake Bay Program Segmentation Scheme document can be viewed and downloaded at http://www.chesapeakebay.net/pubs.segmentscheme.pdf

1983–1985 SEGMENTATION SCHEME

The original Chesapeake Bay Segmentation Scheme, published in the appendices of *Chesapeake Bay: A Profile of Environmental Change* (Flemer et al. 1983), was developed in the late 1970s and early 1980s. This initial segmentation scheme formed the spatial aggregation scheme for station network design of the baywide water quality and biological monitoring programs that were initiated in the mid 1980s,

The 1983–1985 scheme was based primarily on salinity, circulation and natural features, and secondarily on biological factors and management objectives. The salinity data record on which the scheme was based extends to the late 1940s, but for many parts of the Chesapeake Bay, the data were at best patchy in time and space, and at worst, nonexistent.

1997–1998 REVISED SEGMENTATION SCHEME

Early in 1997, in preparation for tributary basin analyses in support of the 1997 Nutrient Reduction Re-evaluation, members of the Chesapeake Bay Program Monitoring Subcommittee's Data Analysis Workgroup proposed the existing segmentation scheme be revised to facilitate better linkages between water quality and living resources. Since distribution and abundance of plankton, submerged aquatic vegetation (SAV) and most other estuarine communities are strongly dependent on salinity, the spatial aggregation of plankton, SAV and water quality data for the Re-evaluation was to be based on salinity regimes. Water quality analyses for the Re-evaluation focused on changes occurring during the 12-year period 1985 to 1996, a period dominated in later years by higher than normal flows, causing relatively large shifts in salinity zone boundaries. The salinity zones were defined as tidal fresh (0–0.5 ppt), oligohaline (>0.5–5 ppt), mesohaline (>5–18 ppt) and polyhaline (>18 ppt).

In the 1983 segmentation scheme, many segments contained stations with widely differing salinity characteristics. Some segments aggregated stations and waters with seemingly disparate influences. Other needs for modification were also identified e.g., correcting earlier station mis-assignments and modifying segment boundaries to account for near shore characteristics impacting SAV assessments. The 1997 Nutrient Reduction Re-evaluation provided an opportunity to make these revisions. However, not all of the planned work was completed by the time the re-evaluation analyses had to be undertaken, so those data analyses used the interim segmentation scheme as it then existed in 1997. Further work on revising the segmentation scheme was then picked up again in 1998 and brought to a state of closure in 2003.

2003 SEGMENTATION SCHEME REFINEMENTS

Between 1998 and 2003, a few inadvertent errors in station coordinates and segment lines had been discovered and corrected. For the most part, the changes were small and undetectable at the scale of the figures in referenced segmentation scheme document. However, discrepancies might show up as small differences in volume, area or perimeter citations for affected segments. The segmentation scheme was expanded in the Potomac River to incorporate additional below-fall line stations in the Potomac and Anacostia rivers. In addition, a new segment was created for the Anacostia River (ANATF), and in the Elizabeth River, segment ELIMH was redefined as polyhaline and joined with segment ELIPH. The details of all these changes are given in the complete document.

The *Chesapeake Bay Program Analytical Segmentation Scheme Report: Revision, decisions and rationale, 1983–2003* (Chesapeake Bay Program 2004) contains the following maps and tables used to document changes to the segmentation scheme from 1983 through 2003 as well as provide the jurisdictions with detailed documentation on the geographical delineation of each segment's boundaries:

- Maps for the 1983, 1997 and 2003 segmentation schemes;
- Statistics on the perimeter, surface and volume of each Chesapeake Bay Program segment;
- Narrative descriptions of each of the coordinates bounding each Chesapeake Bay Program segment; and
- Maps of all the Chesapeake Bay Water Quality monitoring program stations displayed by segment by Maryland, Virginia and the District of Columbia.

MARYLAND'S SPLIT SEGMENTS FOR SHALLOW-WATER BAY GRASS DESIGNATED USE

The Maryland Department of Natural Resources compared SAV habitat conditions with the proposed water clarity application depths and discovered that certain segments, if left in their entirety, could not meet the water clarity criteria even though they already contained substantial amounts of SAV. The SAV was not growing in proximity to the segment's monitoring water quality station and, therefore, the station measurements were not accurately describing in-situ conditions. In other words, the station measurements might have described poor water quality conditions but the abundant SAV in another part of the segment indicated otherwise. Some segments had sizable areas of SAV but their upper tidal reaches would support little or no SAV growth due to adverse physical conditions.

Due to these discrepancies, Maryland representatives requested certain Chesapeake Bay Program segments be subdivided in order to establish attainable water clarity and SAV restoration goals for those segments. A series of very targeted subdivisions of existing Chesapeake Bay Program segments were made to set even more geographically specific shallow-water designated use boundary delineations based on the agreed upon decision rules for determining the water clarity criteria application depth to support regrowth of SAV beds (U.S. EPA 2003).

The segments involved were Northern Chesapeake Bay (CB1TF), Elk River (ELKOH), Gunpowder River (GUNOH), Sassafras River (SASOH), Middle Potomac River (POTOH), Lower Patuxent River (PAXMH), Tangier Sound (TANMH), Manokin River (MANMH) and Big Annemessex River (BIGMH). General subdivision boundaries were assigned. The majority of a given segment was retained, with one or more sections of the segment being partitioned. When actually defining the subdivision boundaries digitally, physical features such as points of land, mouths of tidal creeks, etc. were used as end points wherever possible. In some segments, such as Manokin River and Big Annemessex River, a 'natural break' between an area containing a lot of SAV and an area without little or no SAV was used to guide where the subdivision boundary line was drawn.

The same analyses that were done to ascertain the original water clarity criteria application depths were performed on the new segment subdivisions to assign new application depths. Most of the main portions of those subdivided segments maintained their original water clarity criteria application depths while two (Sassafras River and Lower Patuxent River) had their application depths increased to 1–2 meters in depth. The smaller subdivisions had application depths ranging among all three-depth classes: 0-0.5, 0.5-1 and 1–2 meters.

Figure III-1 shows those Chesapeake Bay Program segments that were subdivided and their new water clarity criteria application depths. Appendix B lists and spatially defines the subdivided segments.

VIRGINIA'S UPPER JAMES RIVER SPLIT SEGMENT

The James River tidal fresh segment (JMSTF) was sub-divided into an upper segment (JMSTF2) and a lower segment (JMSTF1) at the request of Virginia representatives. The upper segment which extends from Richmond to Hopewell (JMSTF2) is narrower, faster flowing, and with much greater average depth. This translates to a lower residence time for algal biomass to develop (i.e., naturally lower chlorophyll *a* levels) as well as less available habitat for SAV. The river widens from approximately 0.4 miles across at the end of segment JMSTF2 to as much as 1.6 miles shortly downriver in the segment JMSTF2 region of Hopewell. The Appomattox River enters the James River here. There are much wider shoals (i.e., greater natural SAV habitat availability), and a greater photic zone area due to the increased width-depth ratio. The greater photic zone area and greater residence time leads to naturally higher chlorophyll *a* levels in JMSTF1.

Figure III-2 shows the subdivided upper James River segments and their new water clarity criteria application depths. Appendix B lists and spatially defines the subdivided segments.

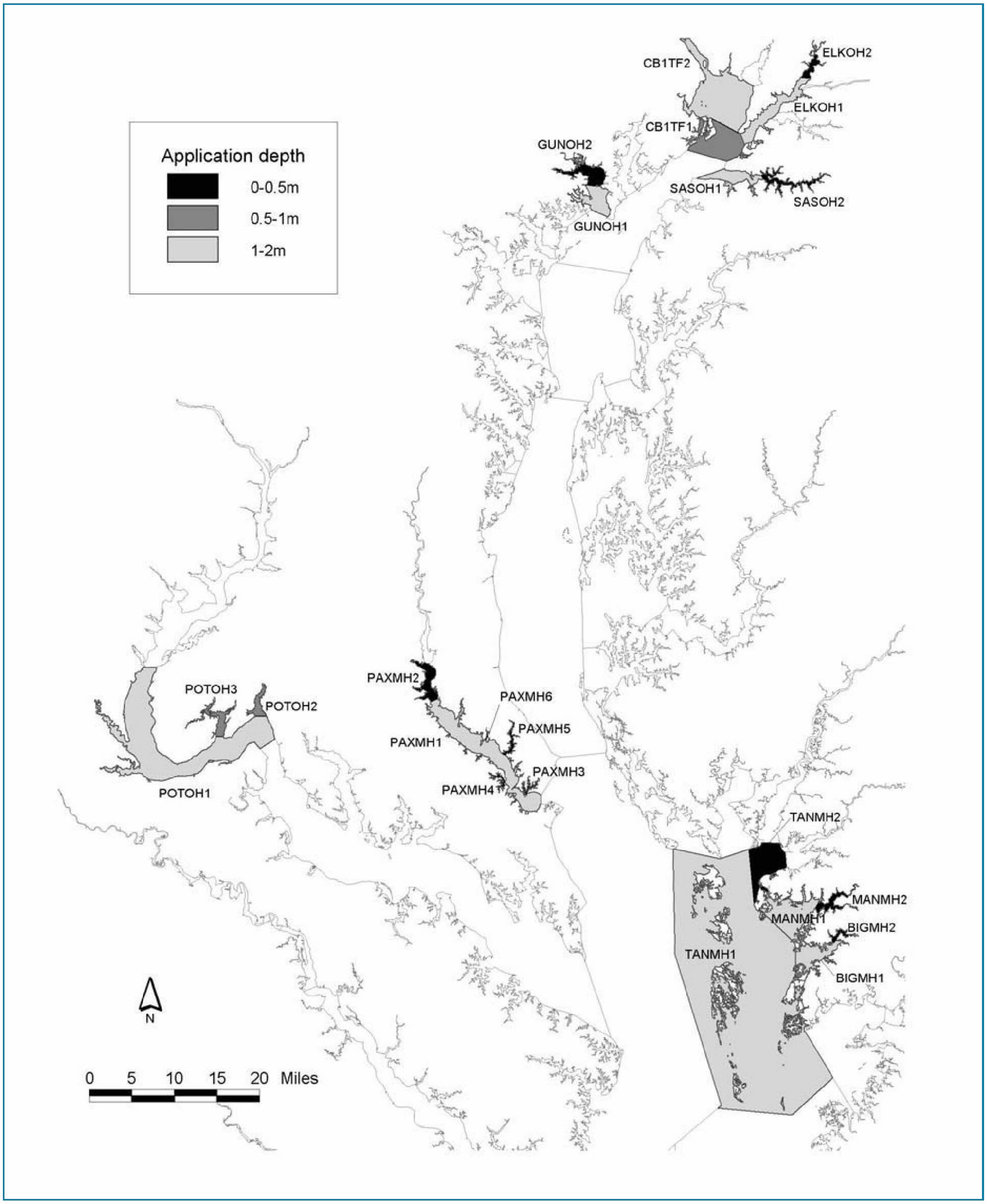

Figure III-1. Maryland's split Chesapeake Program segments for the delineation of the shallow-water bay grass designated use and determination of the resultant water clarity criteria application depths.

Source: Chesapeake Bay Program GIS

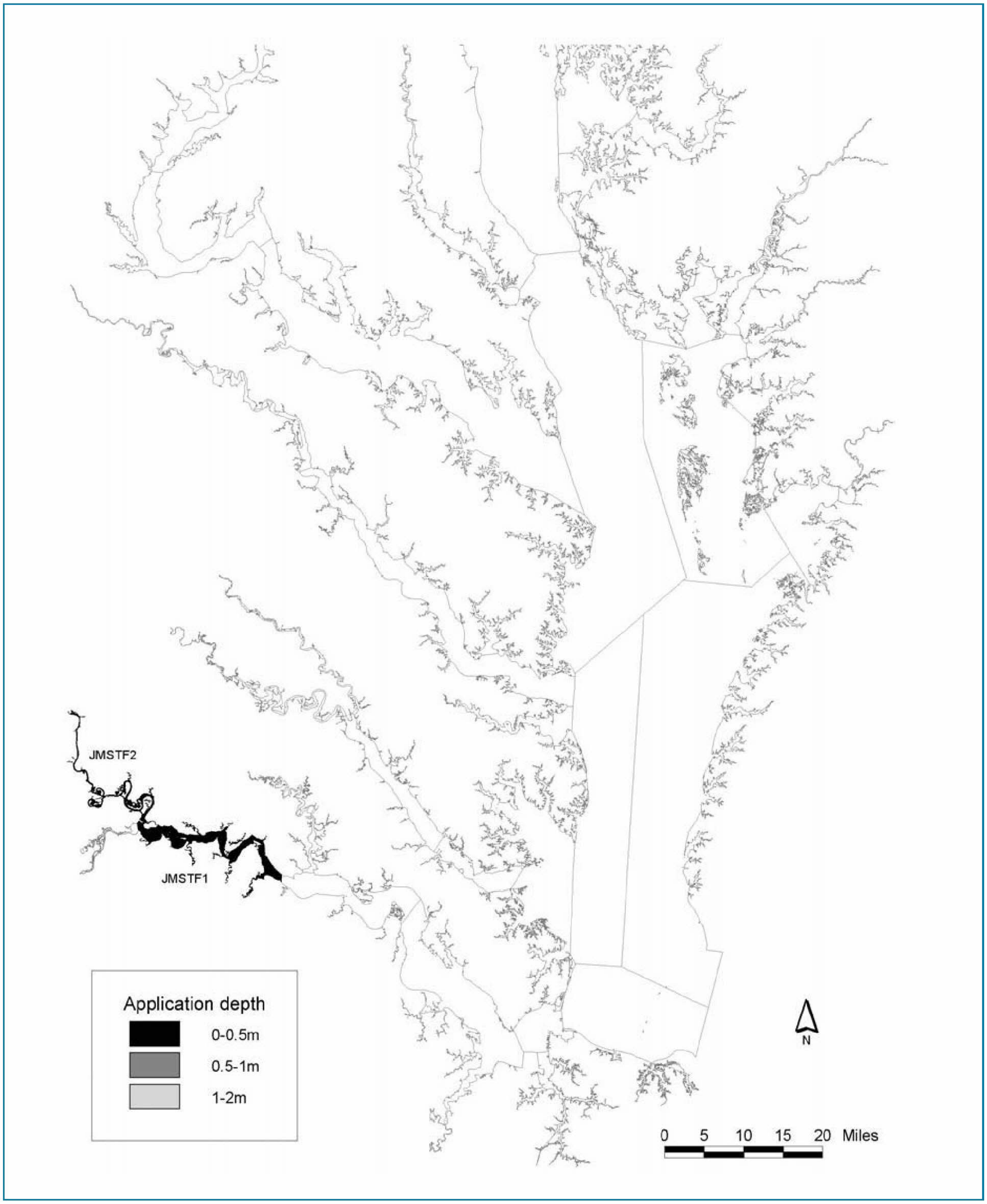

Figure III-2. Virginia's split tidal fresh James River Chesapeake Program segments for the delineation of the shallow- water bay grass designated use and determination of the resultant water clarity criteria application depths and application of chlorophyll *a* criteria.

Source: Chesapeake Bay Program GIS

LITERATURE CITED

Chesapeake Bay Program 2004. *Chesapeake Bay Program Analytical Segmentation Schemes: Revision, decisions and rationales, 1983–2003* CBP/TRS 268/04. Chesapeake Bay Program Office, Annapolis, MD

Flemer, D.A., G.B. Mackieman, W. Nehlsen, V.K. Tippie, R. B. Biggs, D. Blaylock, N.H. Burger, L.C. Davidson, D. Haberman, K.S. Price and J.L. Taft, 1983. *Chesapeake Bay: A Profile of Environmental Change*. E.G. Macalaster, D.A. Barker and M. E. Kasper, eds. U.S. Environmental Protection Agency, Chesapeake Bay Program, Washington, D.C. 120 pages and Appendices.

chapter iv
Tidal Potomac River Jurisdictional Boundaries

In the process of allocating the SAV restoration goals among the three jurisdictions sharing the tidal waters of the Potomac River—Maryland, Virginia and the District of Columbia—it became apparent that those Chesapeake Bay Program segments shared by more than one jurisdiction (Upper Potomac River, Middle Potomac River, Lower Potomac River) needed to be subdivided, so that each jurisdiction was only responsible for the restoration of the amount of SAV within their borders. However, there was no single legally recognized set of geographic boundary data for the Potomac River that all of the jurisdictions were using. This chapter documents the creation of a single jurisdictional boundary file for the tidal Potomac River that all three jurisdictions could agree upon.

After examining several different digital boundary files, it was determined that the best boundary along the Virginia shoreline was one produced by the Virginia Department of Conservation and Recreation (VA DCR). The VA DCR boundary is mostly based on the state boundaries appearing on digital 1:24,000 scale quad sheets (DRGs). The Maryland-Virginia state boundaries delineated on the quad sheets appear to be based on the Mathews-Nelson Survey of 1927, which used the legally defined boundary of the low-water mark on the Virginia side of the river, except where embayments were crossed from one point on land to another point on land. However, shorelines can change in almost 80 years since the original survey, either through natural or anthropogenic influences, which may partially account for discrepancies between the legal definition of the boundaries and how the data appear today. The state boundaries were digitized on-screen using the DRGs as a background upon which to trace the line work. In the lower Potomac River, VA DCR used 1:12,000 scale digital orthophoto quarter quads (DOQQs) having photo dates of 1992–1996 as the source for the boundary definition.

For the Maryland-District of Columbia boundary lines that cross the Potomac diagonally from the Virginia shoreline, data provided by the District of Columbia Department of Health's Water Quality Control Branch were used. These and the VA DCR data were merged to create a boundary file that all three jurisdictions agreed to use in allocating SAV restoration goals and acreages of shallow-water habitat in those shared segments (see Chapter 6 for actual acreages). A series of 12 maps that illustrate the jurisdictional boundaries follows as Figures IV-1 through Figures IV-12

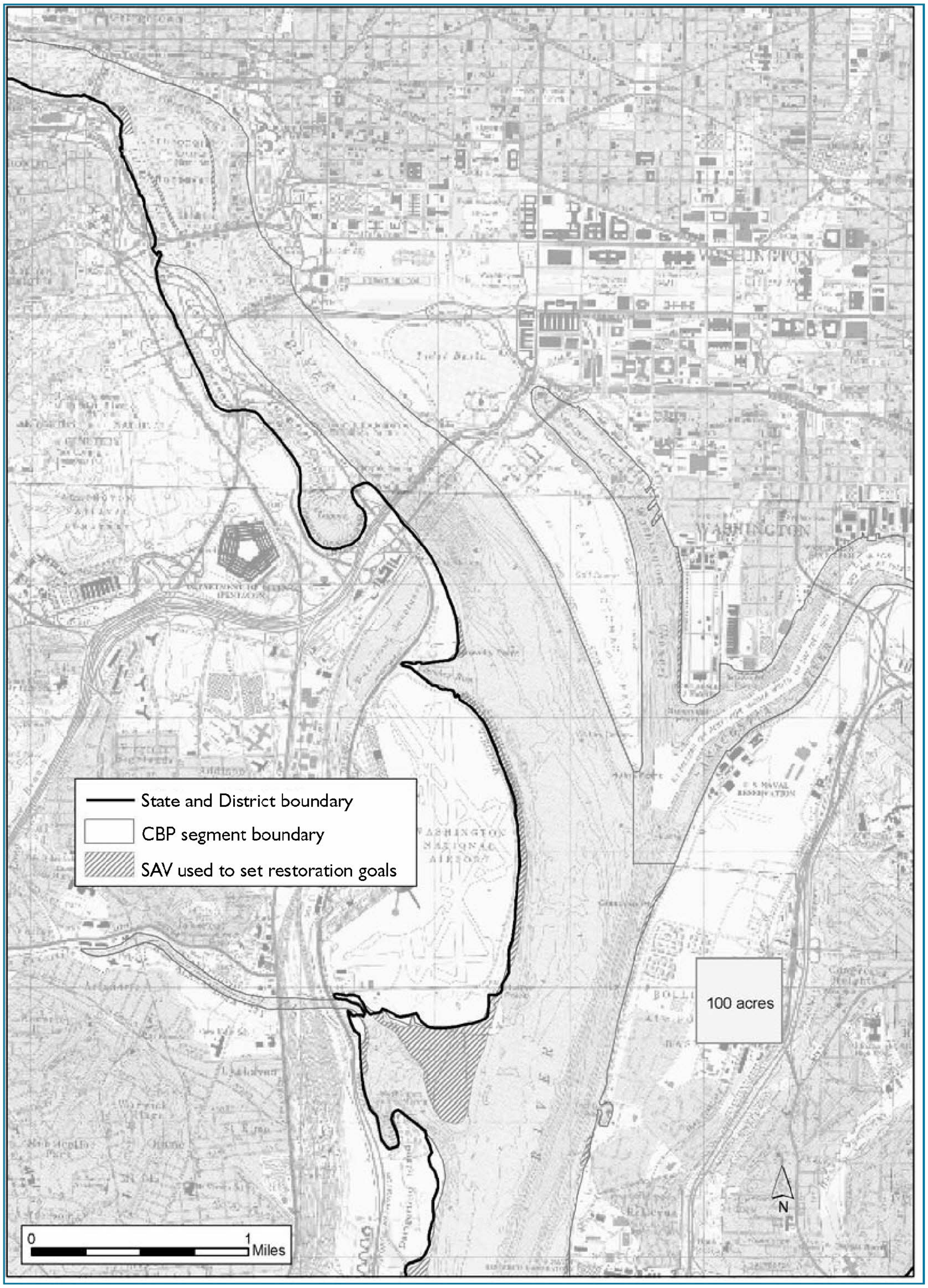

Figure IV-1. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from Three Sisters Island to just south of Daingerfield Island.

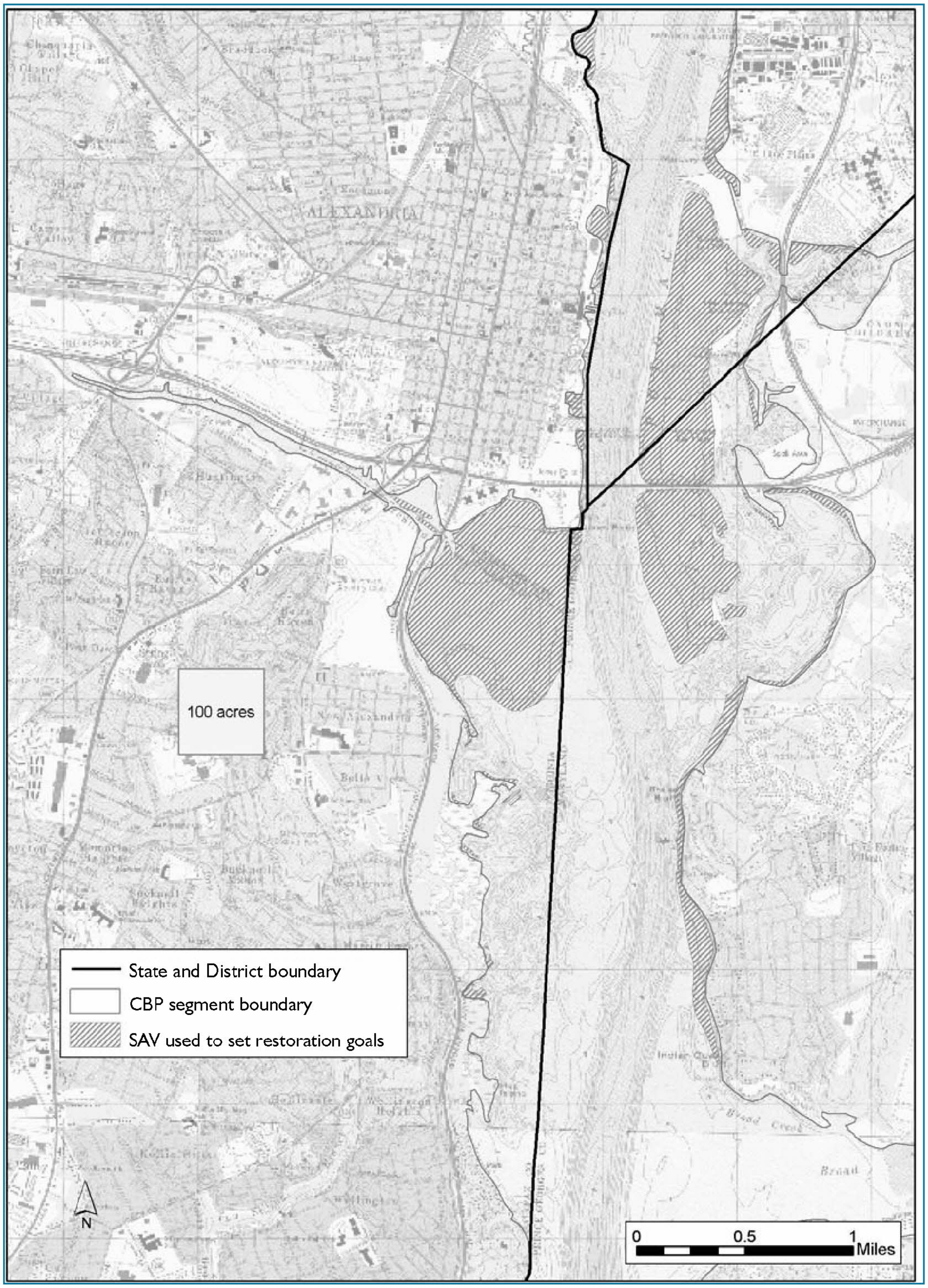

Figure IV-2. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from Daingerfield Island to Arcturus.

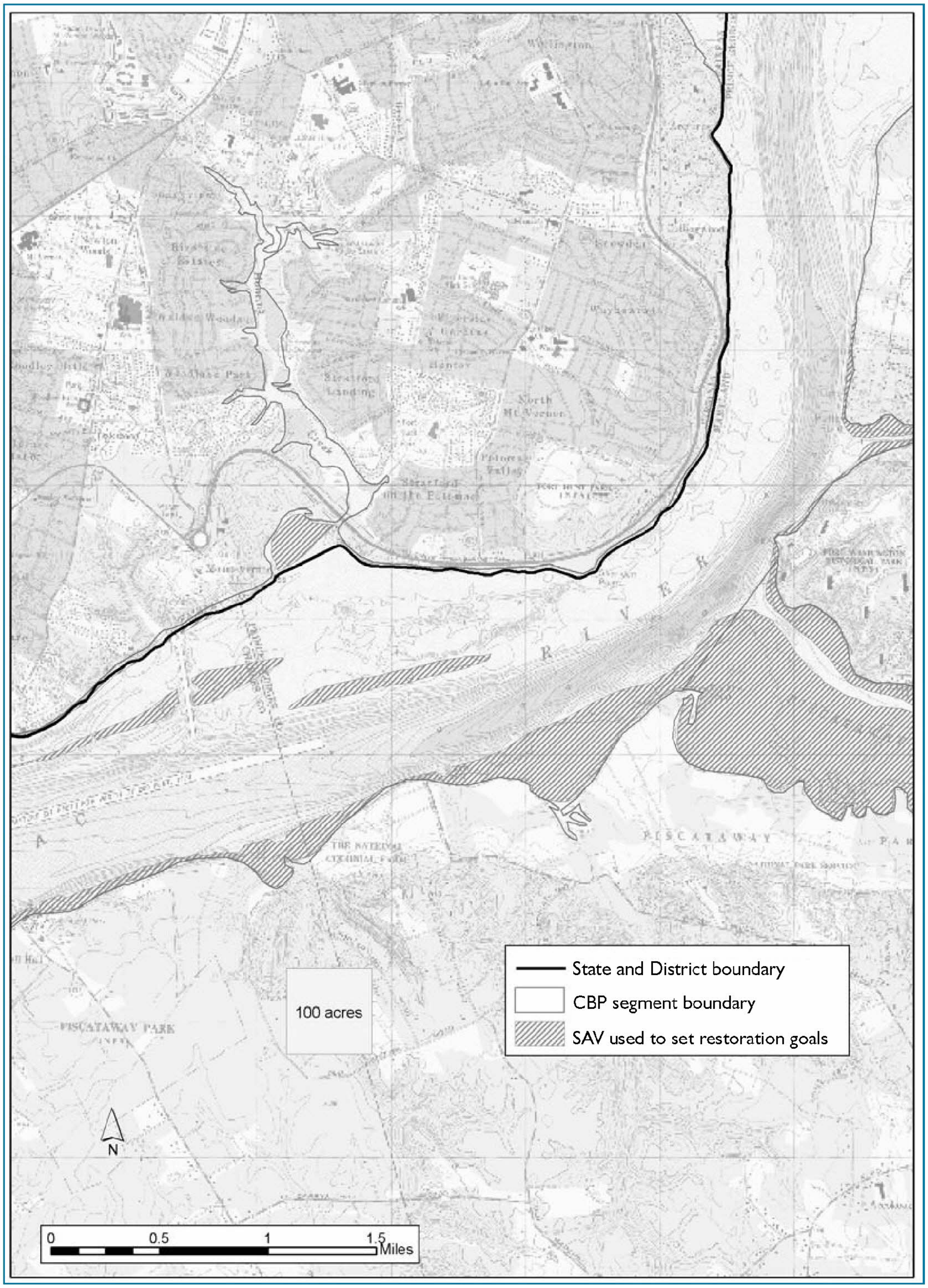

Figure IV-3. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from Wellington to east of the mouth of Dogue Creek.

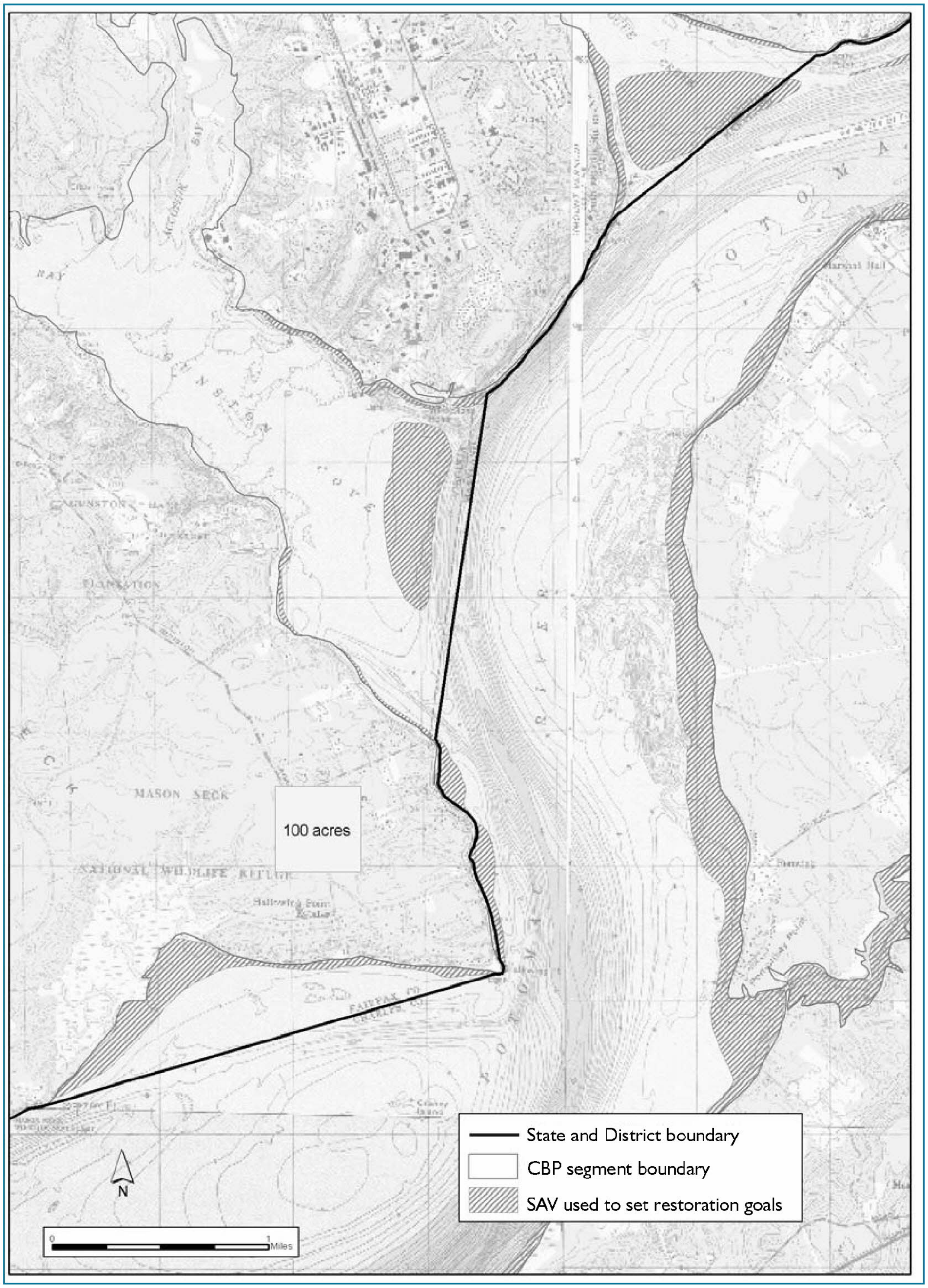

Figure IV-4. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from east of Dogue Creek to the Mason Neck National Wildlife Refuge and Potomac Shoreline Regional Park boundary.

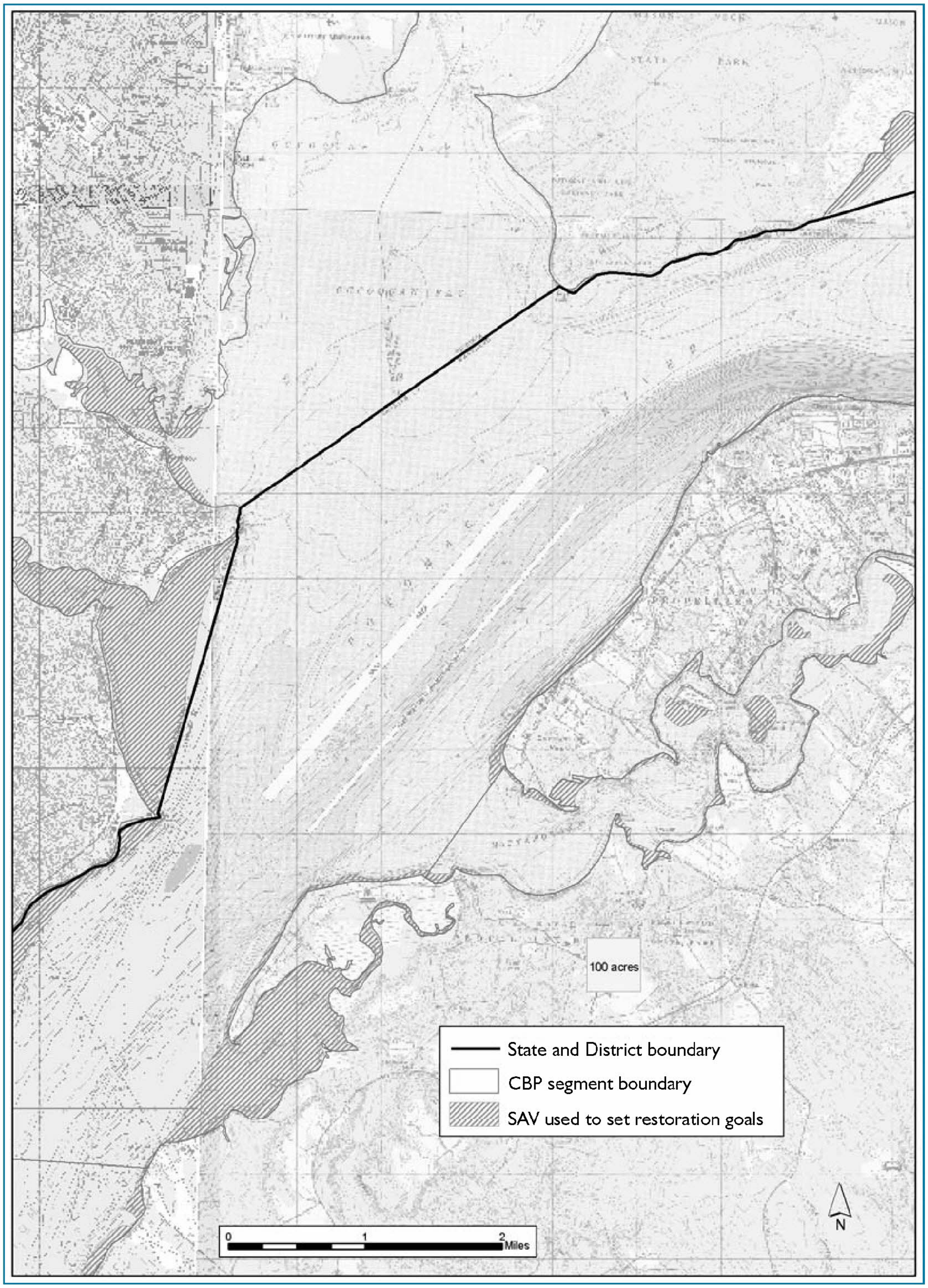

Figure IV-5. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from Mason Neck National Wildlife Refuge to southwest of Cockpit Point.

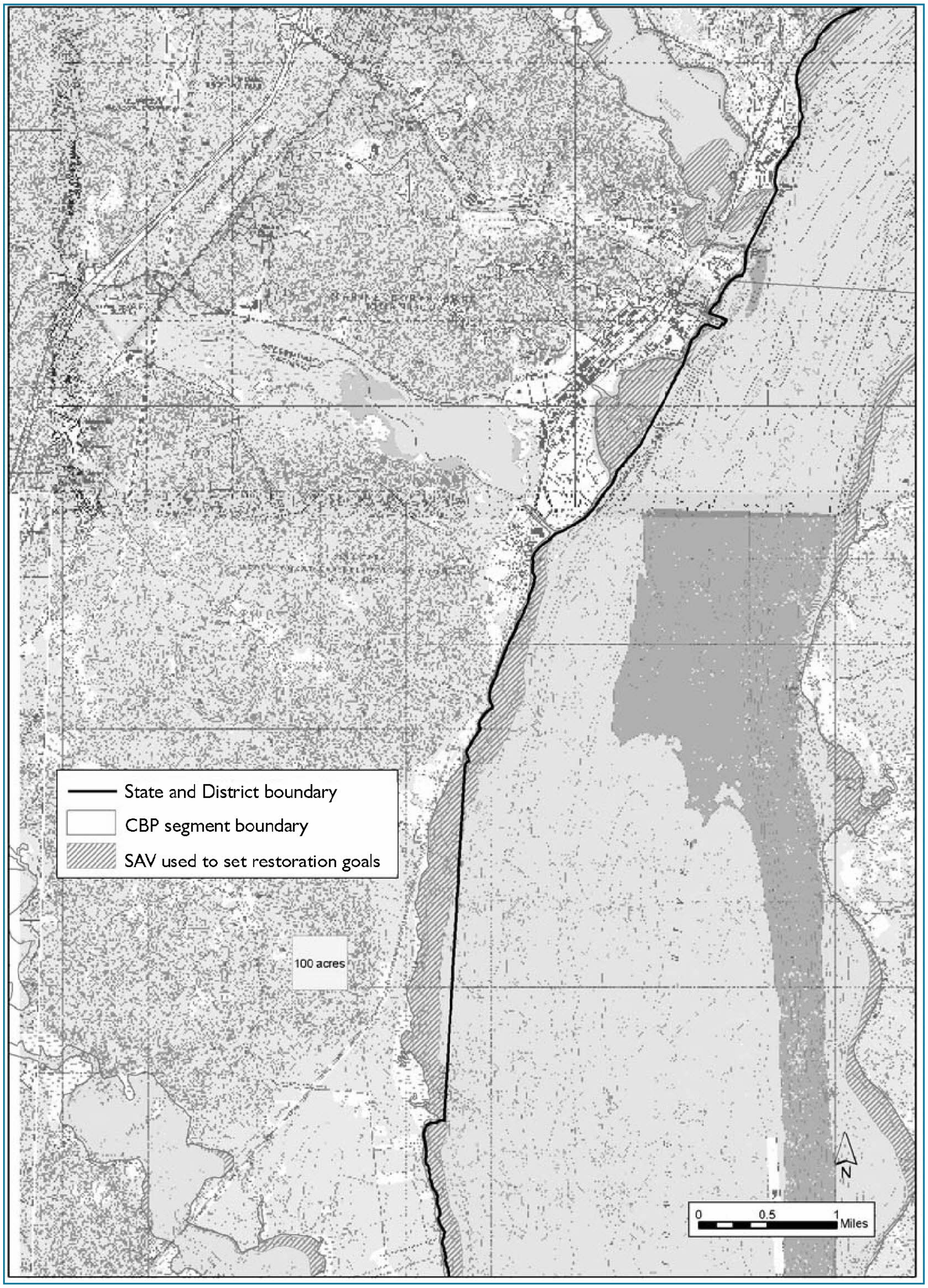

Figure IV-6. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from north of Possum Point to south of Brent Marsh.

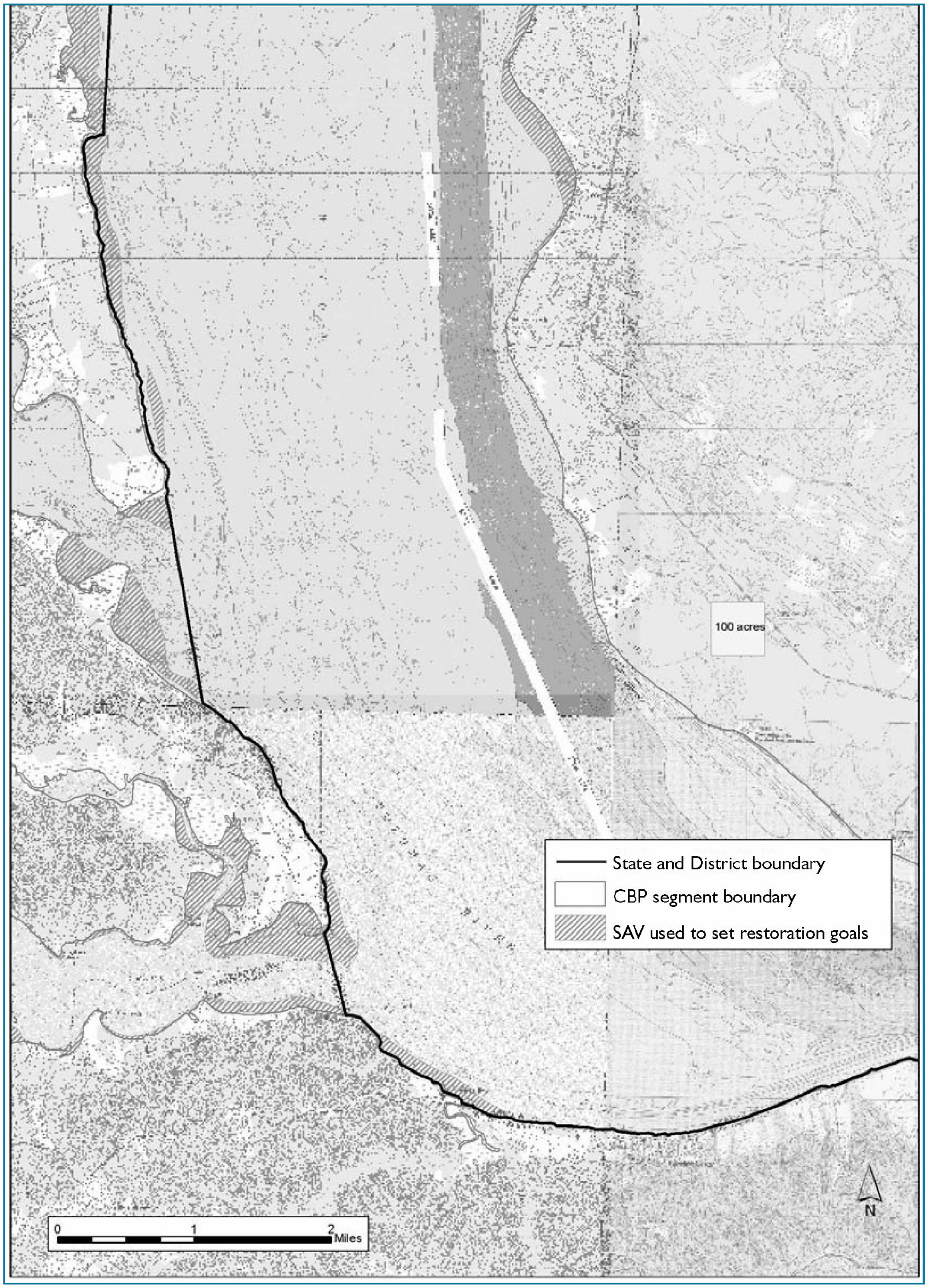

Figure IV-7. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from Brent Marsh to east of Fairview Beach.

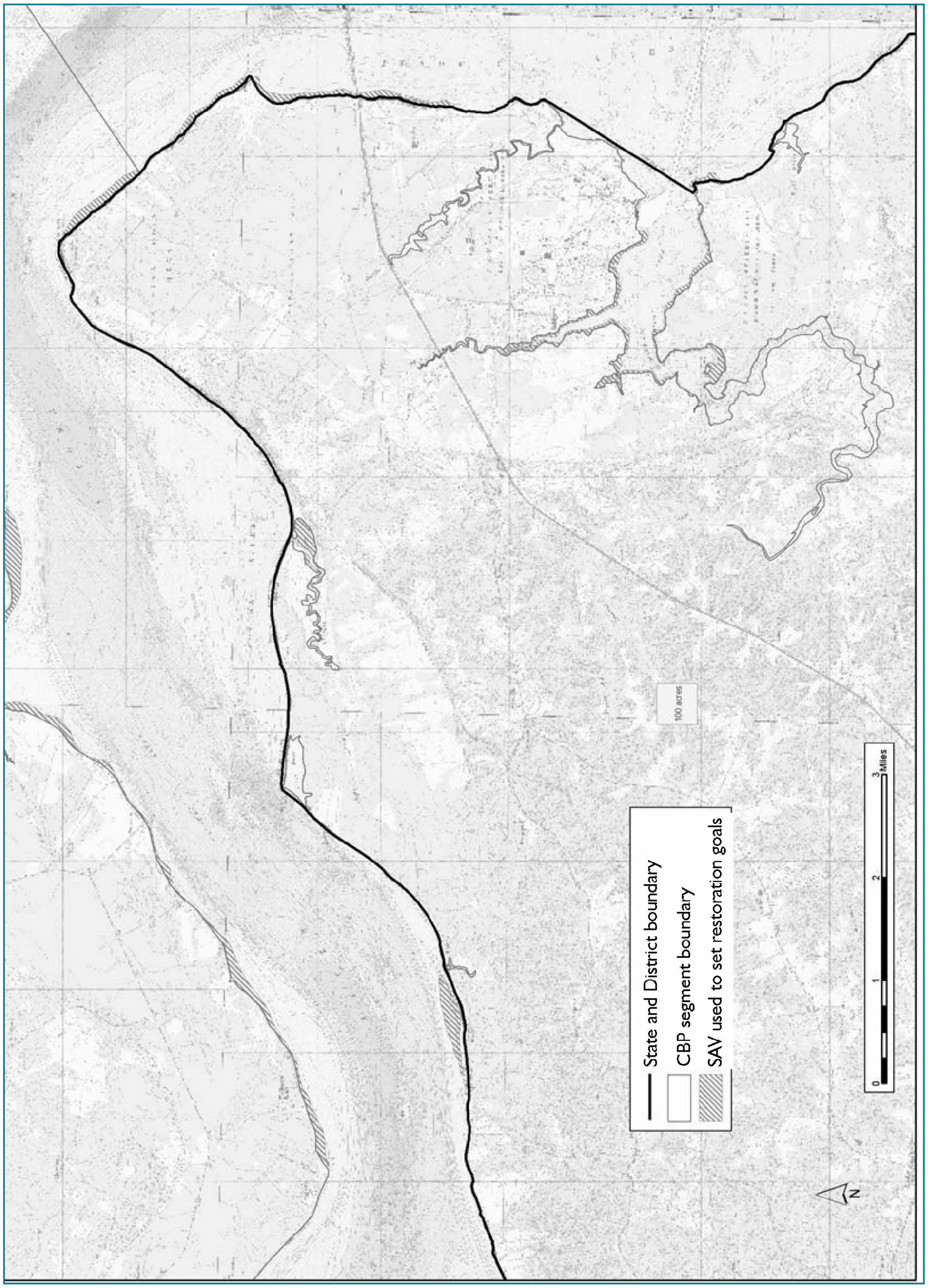

Figure IV-8. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from east of Fairview Beach to 0.1 miles north of Rosier Creek.

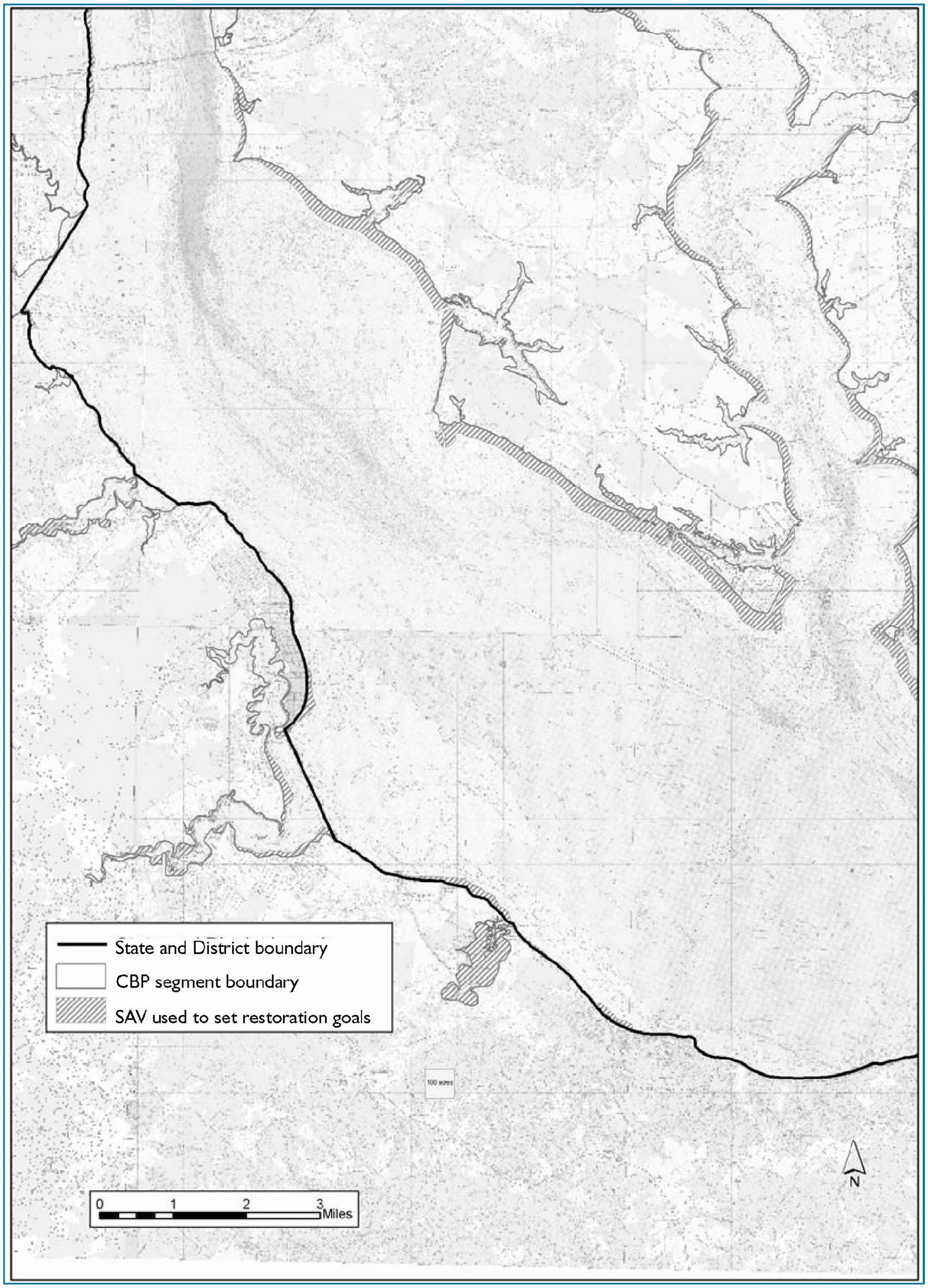

Figure IV-9. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from north of Route 301 Bridge to Nomini Cliffs.

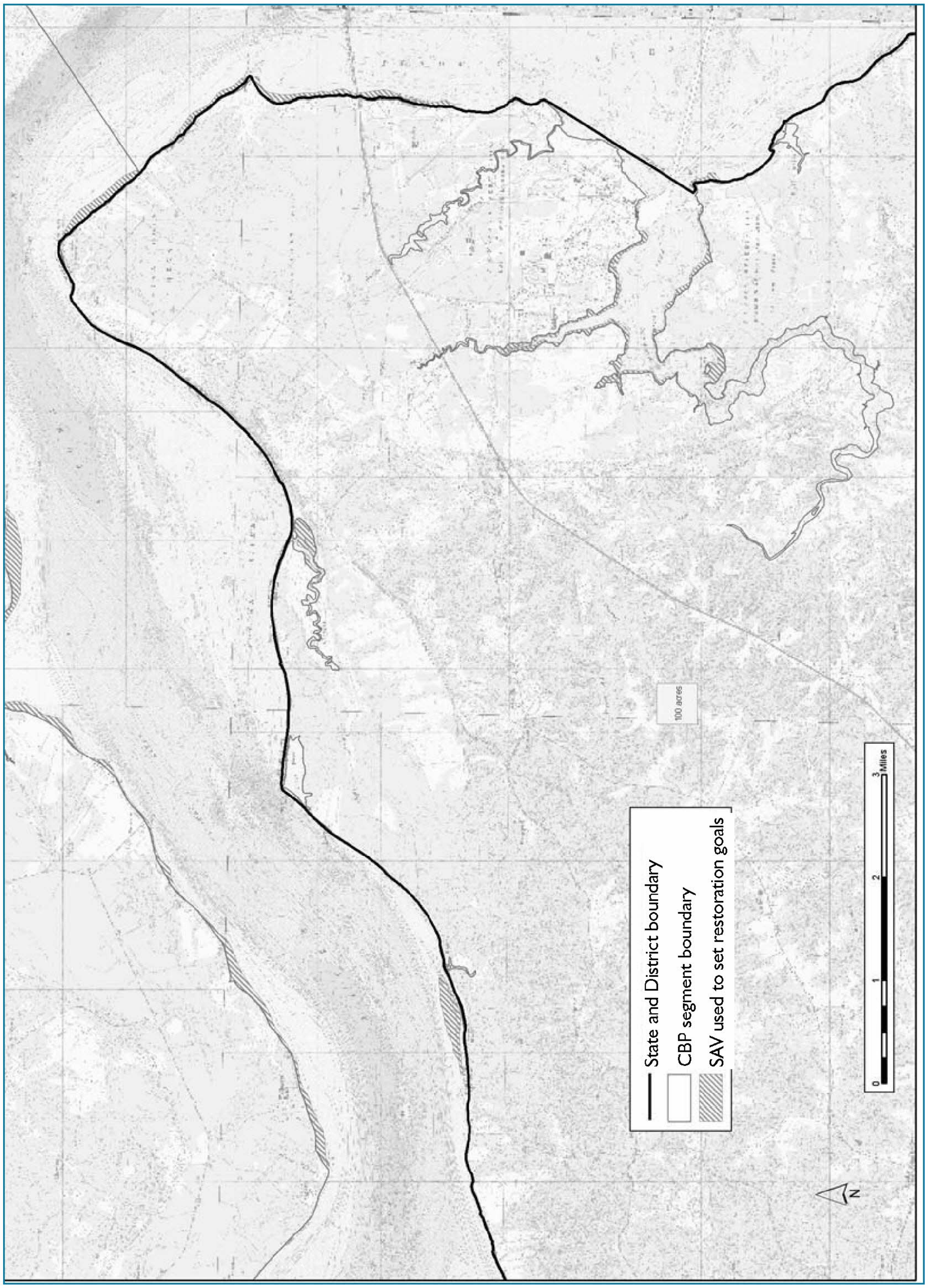

Figure IV-10. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from between Big Meadow and Little Meadow Runs to Ragged Point Beach.

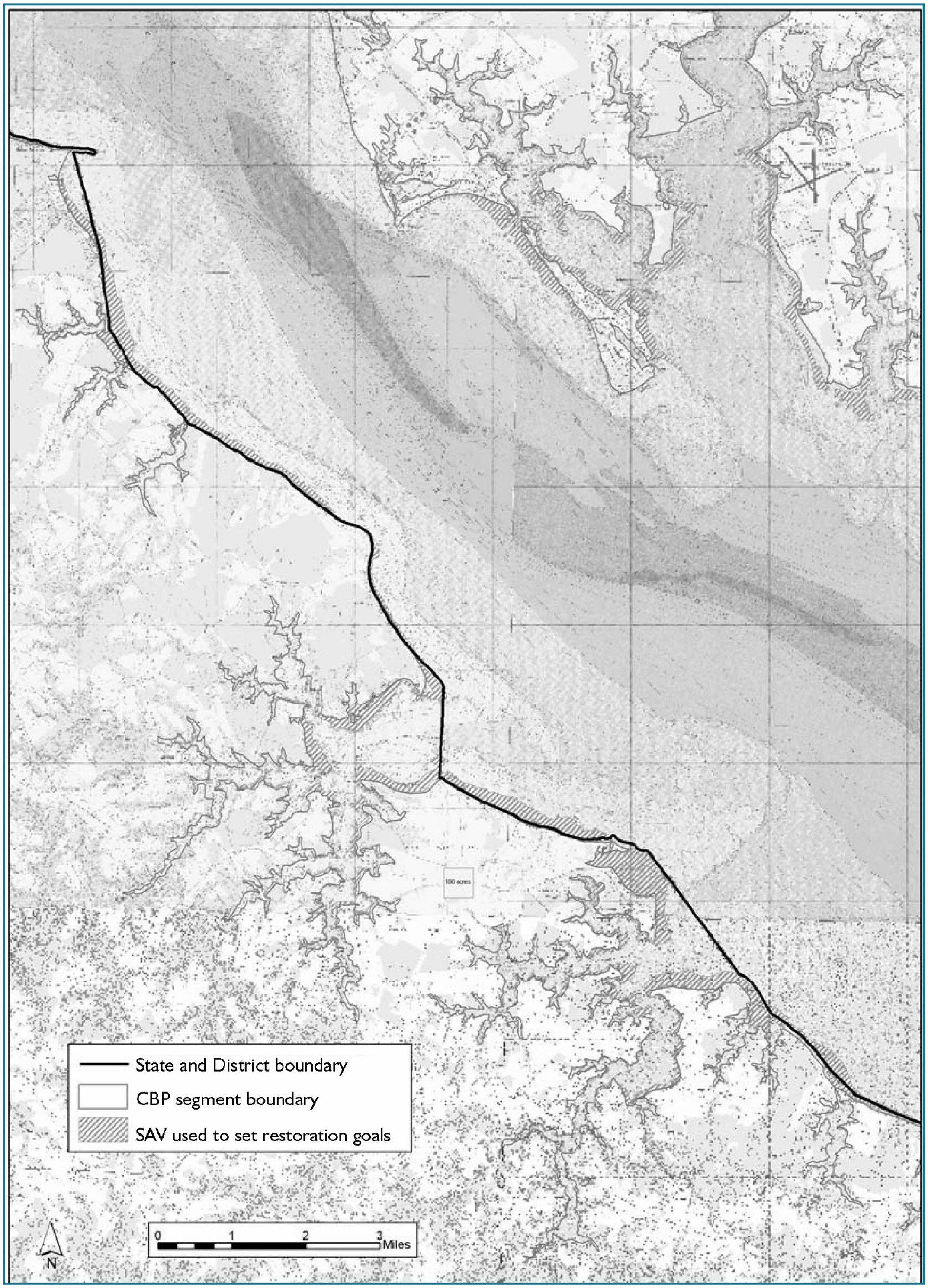

Figure IV-11. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from west of Ragged Point Beach to west of Hull Creek.

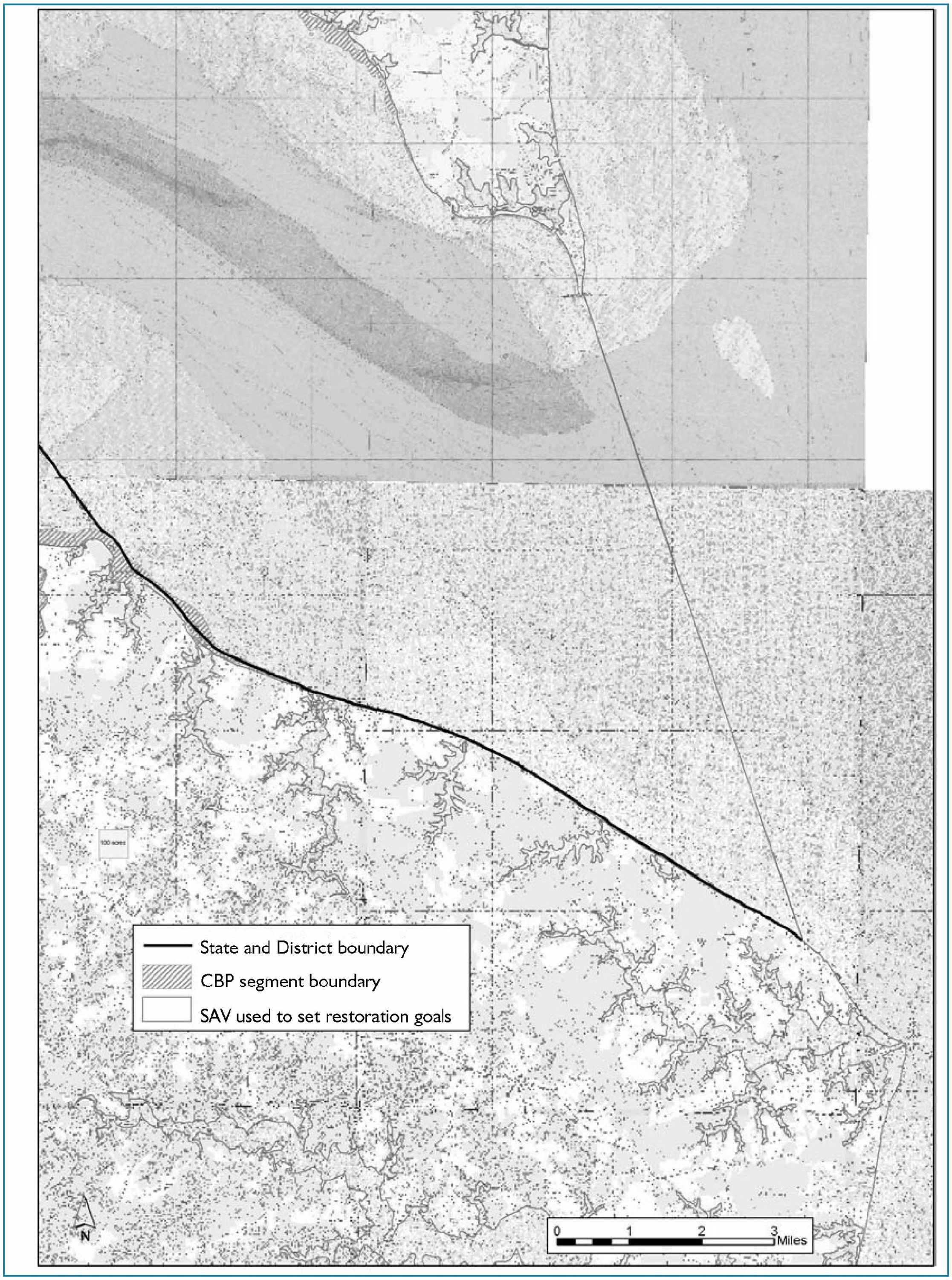

Figure IV-12. Maryland, Virginia and District of Columbia jurisdictional boundaries along the tidal Potomac River used to allocate SAV restoration goal and shallow-water habitat acreages among the three jurisdictions: from Walnut Point, Coan River to mouth of the Potomac River.

chapter V

Expanded Documentation on the Chesapeake Bay SAV No-Grow Zones

Building upon the previously published descriptions of Chesapeake Bay SAV no-grow zones in the *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability* (U.S. EPA 2003) (see pages 108-110), this chapter provides additional, more detailed graphical and tabular documentation.

In summary, the methodology for revising and updating the SAV no-grow zones was as follows:

1. The process started with the originally designated SAV no-grow zones published in 1992 (Batiuk et al. 1992, 2000).
2. A single composite of all SAV mapped during the1978–2002 SAV aerial surveys along with SAV mapped from historical 1930s through early 1970s aerial photography was generated and overlaid on the original 1992 SAV no-grow zones.
3. Where the composite map of historical and recent SAV distributions indicated no evidence of SAV growth, the 1992 SAV no-grow zones were designated across the entire 0–2 meter depth contour.
4. Where the composite map of historical and recent SAV distributions indicated evidence of SAV growth in the 0-1 meter depth contour, but there were strictly physical reasons (wind fetch, wave action, offshore bars) to believe SAV could not grow at depths deeper than 1 meter, the 1992 SAV no-grow zones were designated only across the 1–2 meter depth contour.
5. Additional SAV no-grow zones were delineated in the upper Nanticoke, Wicomico and upper Pocomoke rivers due to the lack of evidence of any historical SAV combined with clear evidence these Eastern Shore systems are directly influenced by inputs of dissolved organic carbon from the extensive adjacent tidal wetlands (“blackwater rivers”) and/or extensive physical channelizing of the rivers to the point of virtually eliminating most shallow water habitats.

Table V-1 provides the acreage, jurisdictions, depth zones and narrative descriptions of the SAV no-grow zones. Since the SAV no-grow zones were based on depth, physical limitations to underwater bay grasses growth and historical presence or

Table V-1. Locational descriptions of the Chesapeake Bay SAV no-grow zones

CBP Segment Name	CBP Segment	Acres	State(s)	No grow zone at 0-2m depth*	No-grow zone at 1-2m depth*	Description
Northern Chesapeake Bay	CB1TF	679.1	MD	X		Eastern shore and one area in the middle of the segment; see Figure V-1.
Upper Chesapeake Bay (East)	CB2OH	1564.4 #	MD	X		Eastern shore (0-2m): from CB1TF to SASOH boundaries and from the tower S of Big Fairlee Pond to CB3OH boundary.
Upper Chesapeake Bay (West)	CB2OH	1564.4 #	MD		X	Western shore (1-2m); see Figures V-2 and V-3.
Upper Central Chesapeake Bay	CB3MH	4536.5	MD	X	X	Almost all 0-2m depth along Western shore; most of 1-2m on Eastern shore except Chester R. and Swan Cr.; see Figures V-3 and V-4.
Middle Central Chesapeake Bay	CB4MH	14589.4	MD	X	X	See Figures V-4 and V-5.
Lower Central Chesapeake Bay	CB5MH	5060.9	MD/VA	X	X	See Figures V-6 and V-7.
Western Lower Chesapeake Bay	CB6PH	3683.8	VA	X	X	Windmill Pt. to Beach Pt.(except E of Milford Haven and an area N of Beach Pt.); Northland Pt. to Grandview; see Figures V-7 and V-8.
Eastern Lower Chesapeake Bay	CB7PH	8338.5	VA	X	X	Most of 2m depth outside of creeks; see Figures V-9, V-10 and V-11."
Mouth of the Chesapeake Bay	CB8PH	1185.4	VA	X		From Grandview (NW) to 0.75 miles E of the Bridge Tunnel, plus along the Bridge Tunnel; see Figure V-11."
Patapsco River	PATMH	1400.2	MD	X		Pier 8, Dundalk Marine Terminal to the southernmost of the 3 long piers N of Ferry Pt. (Curtis Bay): see Figure V-12."
Magothy River	MAGMH	198.5	MD	X		Mountain Pt. (Gibson I.) to CB3MH boundary and from Little Magothy River to CB3MH boundary: see Figures V-4 or V-12.
South River	SOUMH	102.2	MD	X		Both sides of the mouth; see Figure V-4.
Rhode River	RHDMH	375.0	MD	X		Between north side of mouth and southern side of the South River mouth; see Figure V-4.
West River	WSTMH	131.8	MD	X		Eastern side of the segment; see Figure V-4.
Lower Potomac River	POTMH	19.4	MD	X		At the tip of Point Lookout, adjacent to the CB5MH boundary; see Figure V-6."
Lower Rappahannock River	RPPMH	395.4	MD		X	North and south sides of the mouth; see Figure V-7.
Piankatank River	PIAMH	104.9	MD		X	Just beyond the north and south sides of the mouth; see Figure V-7.
Mobjack Bay	MOBPH	634.6	VA	X		Large shallow area ESE of Guinea Neck and Northend Pt. to CB6PH boundary; see Figure V-8.
Lower James River	JMSMH	4312.4	VA	X		See Figure V-8.
Mouth of the James River	JMSPH	618.6	VA	X		See Figure V-8.
Western Branch Elizabeth River	WBEMH	1109.0	VA	X		Entire segment.
Southern Branch Elizabeth River	SBEMH	1006.4	VA	X		Entire segment.
Eastern Branch Elizabeth River	EBEMH	1082.5	VA	X		Entire segment.
Lafayette River	LAFMH	1245.6	VA	X		Entire segment.
Mouth of the Elizabeth River	ELIPH	1460.4	VA	X		Entire segment.
Northeast River	NORTF	0.1	MD	X		Off Red Pt., on boundary with CB1TF; see Figure V-1."
Sassafras River	SASOH	2.4	MD	X		Northern shore at the mouth, adjacent to boundary with CB2OH; see Figure V-2."
Eastern Bay	EASMH	134.4	MD		X	South of Kent Pt., adjacent to boundary with CB4MH; see Figure V-4."
Upper Choptank River	CHOTF	1519.7	MD	X		Entire segment.
Middle Choptank River	CHOOH	452.7	MD	X		From 1000' below Rt. 331 bridge upstream.
Mouth of the Choptank River	CHOMH1	37.3	MD	X		Isolated shallow area SE of Lower Bar Neck Pt.on Tilghman Island; see Figure V-5.
Little Choptank River	LCHMH	5.6	MD	X		At the mouth of creek separating Taylors I. and Meekins Neck; see Figure V-5.
Upper Nanticoke River	NANTF	886.4	MD	X		Entire segment in MD.
Wicomico River	WICMH	469.6	MD	X		Upstream from Green Hill CC , halfway between Simms Wharf and Quantico Wharf."
Big Annemessex River	BIGMH	4.0	MD		X	Adjacent to boundary with TANMH, north of Janes Island; see Figure V-9."
Upper Pocomoke River	POCTF	748.0	MD	X		Entire segment.
Middle Pocomoke River	POCOH	2466.1	MD/VA	X	X	All of Pocomoke Sound plus farther upriver and in tribs; see Figure V-9.
Lower Pocomoke River	POCMH	13293.3	MD/VA	X	X	See Figure V-9.
Tangier Sound	TANMH	6198.4	MD/VA	X	X	See Figure V-9.

\# Acreage is total for segment.
* At least part of segment has no-grow zones at this depth.

absence, these zones can not (in most cases) be described using only a small number of latitude/longitude coordinates. In place of georeferenced descriptions of all the coordinates bounding each SAV no-grow zone, a series of detailed maps have been provided as Figures V-1 through V-12.

LITERATURE CITED

Batiuk, R. A., P. Bergstrom, M. Kemp, E. Koch, L. Murray, J. C. Stevenson, R. Bartleson, V. Carter, N. B. Rybicki, J. M. Landwehr, C. Gallegos, L. Karrh, M. Naylor, D. Wilcox, K. A. Moore, S. Ailstock and M. Teichberg. 2000. *Chesapeake Bay Submerged Aquatic Vegetation Water Quality and Habitat-Based Requirements and Restoration Targets: A Second Technical Synthesis.* CBP/TRS 245/00 EPA 903-R-00-014. U.S. EPA Chesapeake Bay Program, Annapolis, Maryland.

Batiuk, R. A., R. Orth, K. Moore, J. C. Stevenson, W. Dennison, L. Staver, V. Carter, N. B. Rybicki, R. Hickman, S. Kollar and S. Bieber. 1992. *Chesapeake Bay Submerged Aquatic Vegetation Habitat Requirements and Restoration Targets: A Technical Synthesis.* CBP/TRS 83/92. U.S. EPA Chesapeake Bay Program, Annapolis, Maryland.

U.S. Environmental Protection Agency. 2003. *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability.* EPA 903-R-03-004. Region III Chesapeake Bay Program Office, Annapolis, Maryland.

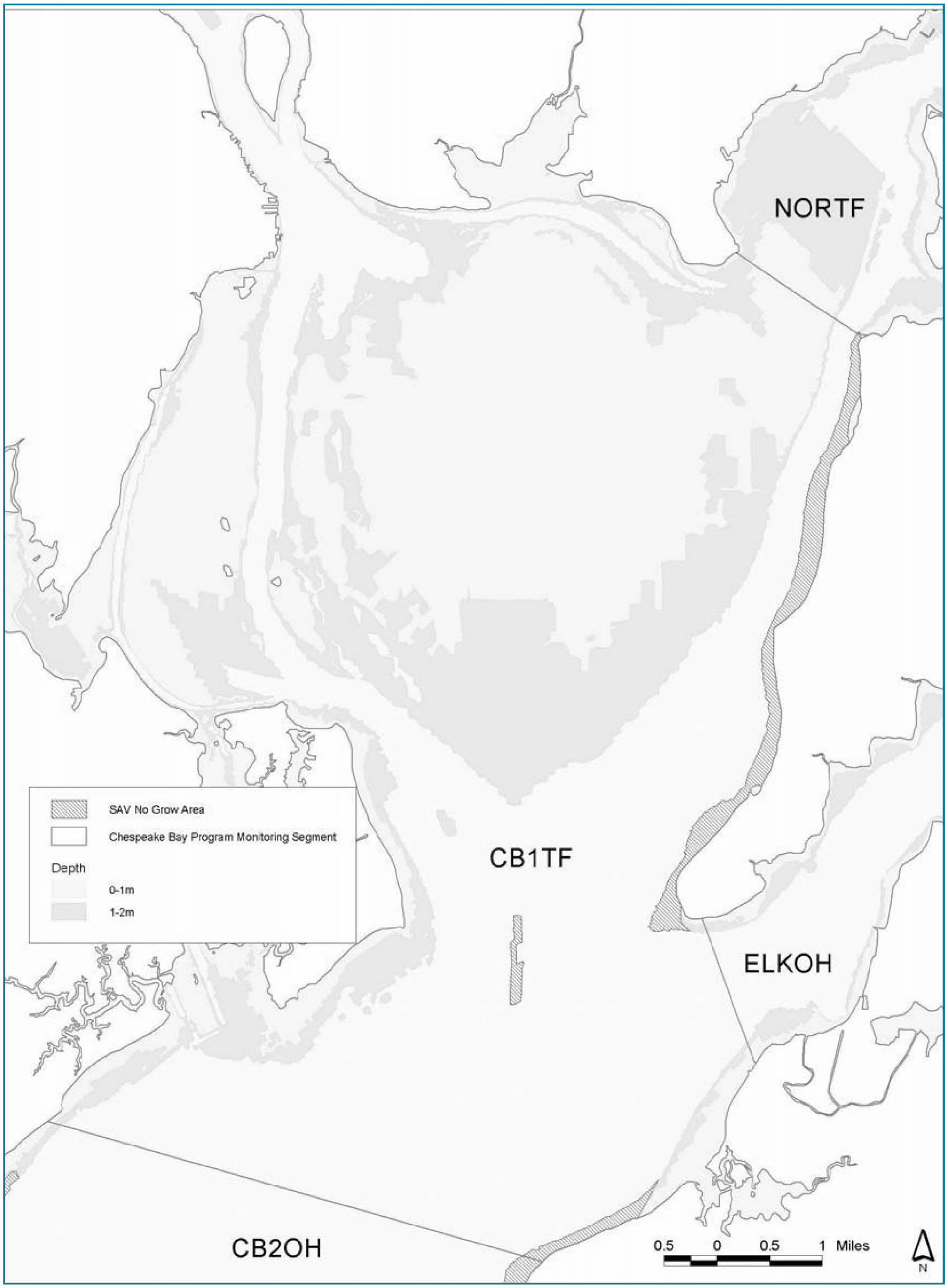

Figure V-1. Chesapeake Bay SAV no-grow zones for the northern Chesapeake Bay (CB1TF) and the Northeast River (NORTF).

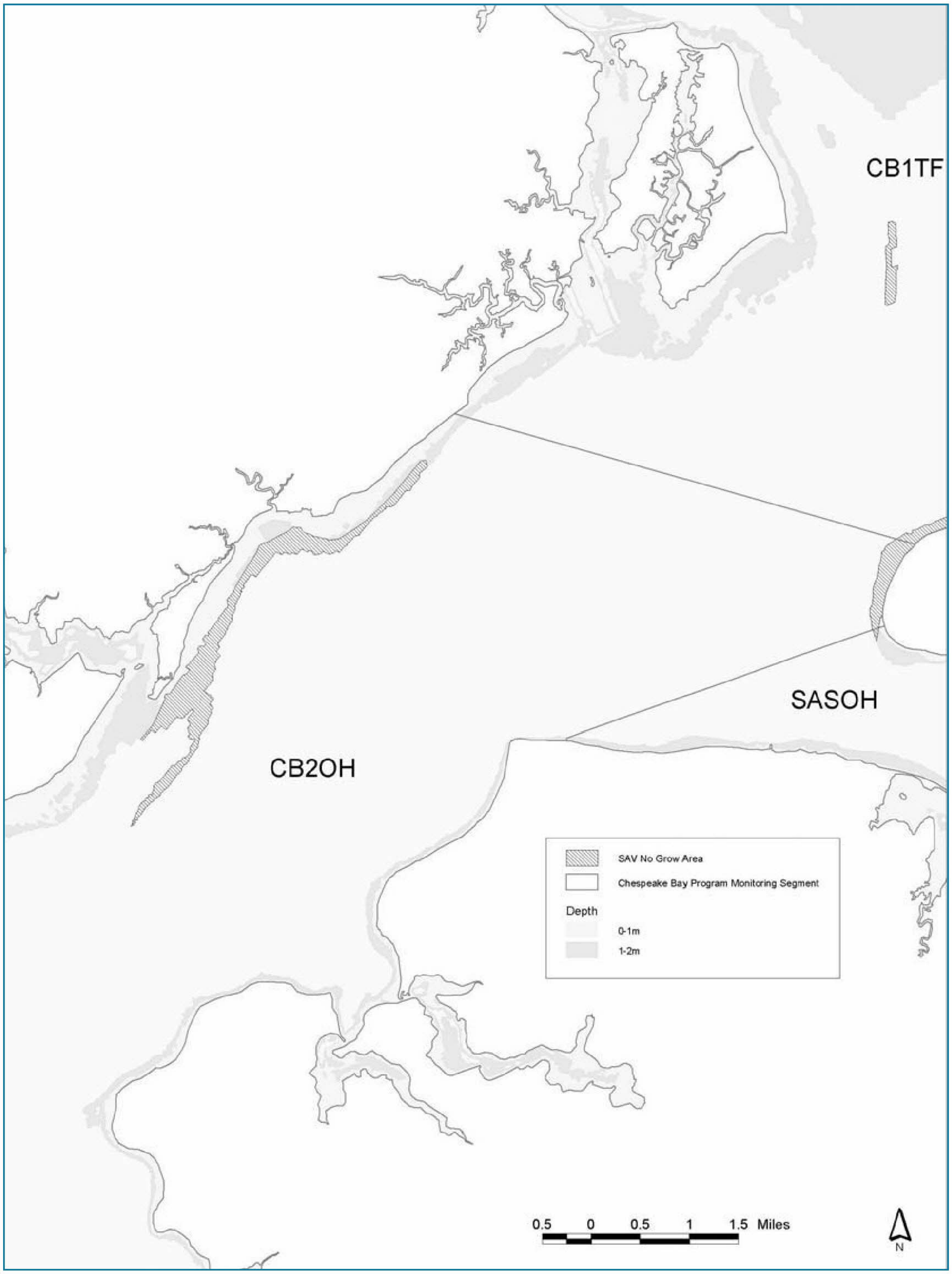

Figure V-2. Chesapeake Bay SAV no-grow zones for the upper section of the upper Chesapeake Bay (CB2OH) and Sassafras River (SASOH).

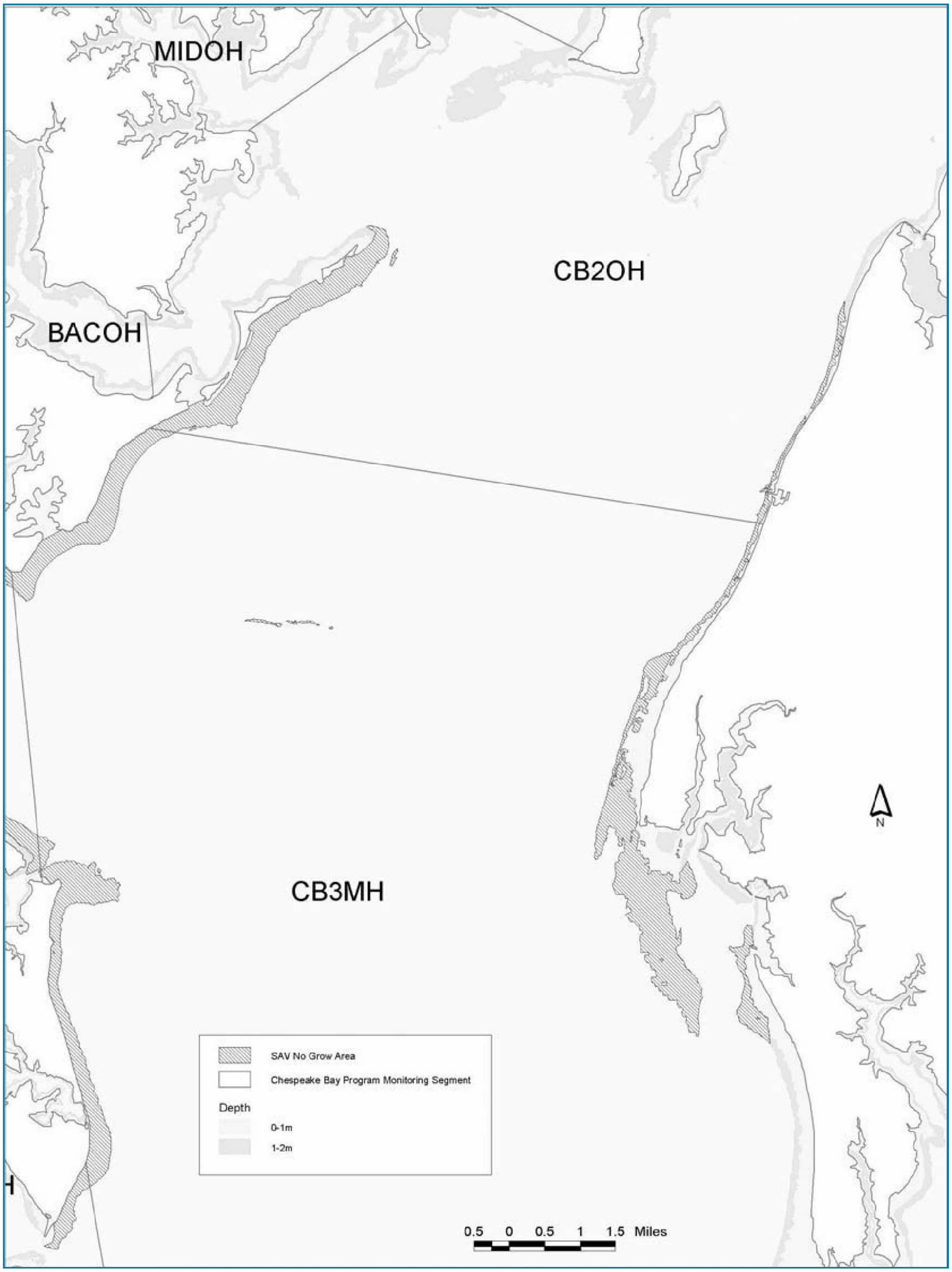

Figure V-3. Chesapeake Bay SAV no-grow zones for the lower section of the upper Chesapeake Bay (CB2OH) and the upper section of the upper central Chesapeake Bay (CB3MH).

AR0011007

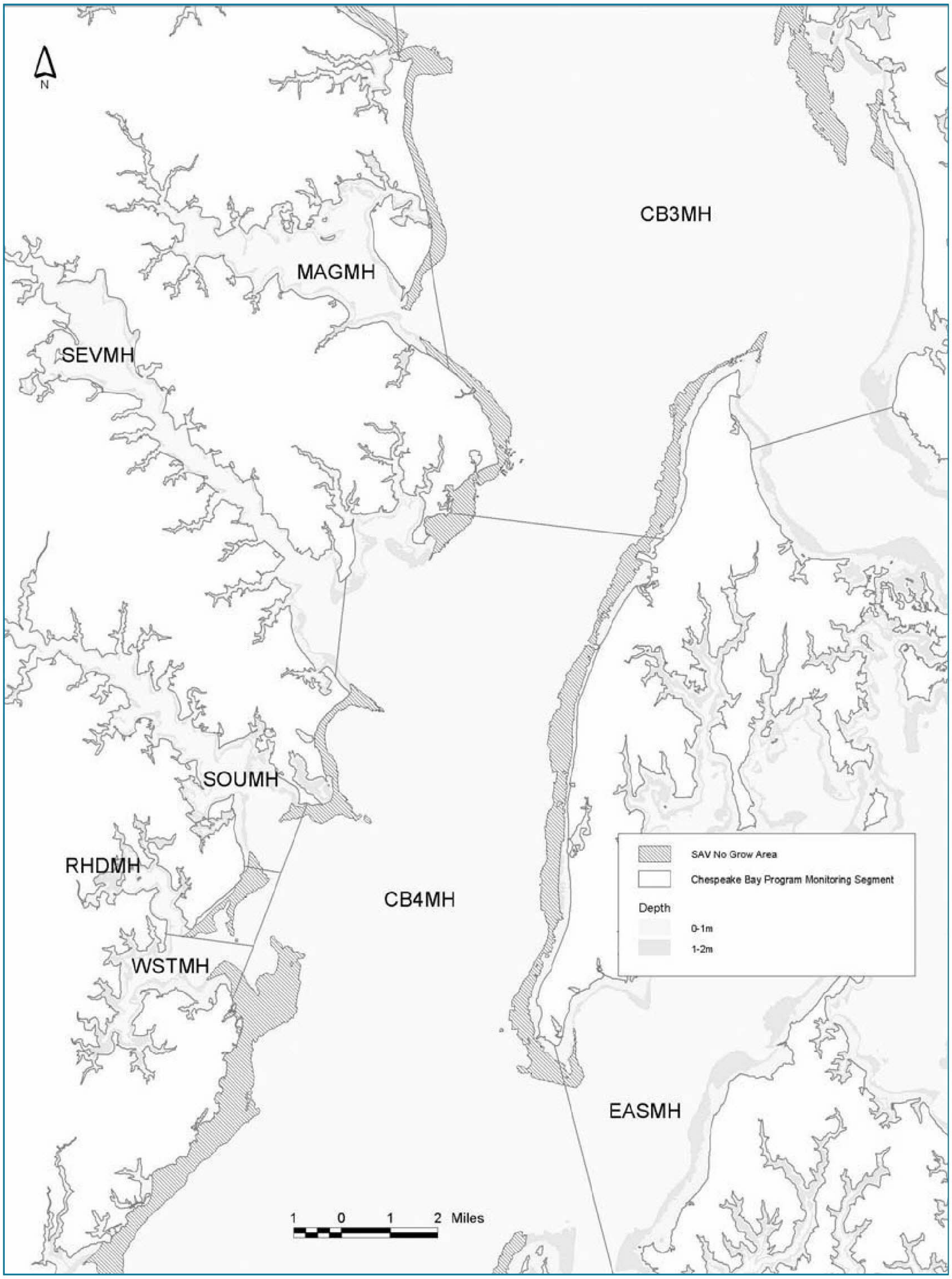

Figure V-4. Chesapeake Bay SAV no-grow zones for the lower section of the upper central Chesapeake Bay (CB3MH), upper section of the middle central Chesapeake Bay (CB4MH), Magothy (MAGMH), Severn (SEVMH), South (SOUMH), Rhode (RHDMH), West (WSTMH) rivers and Eastern Bay (EASMH).

AR0011008

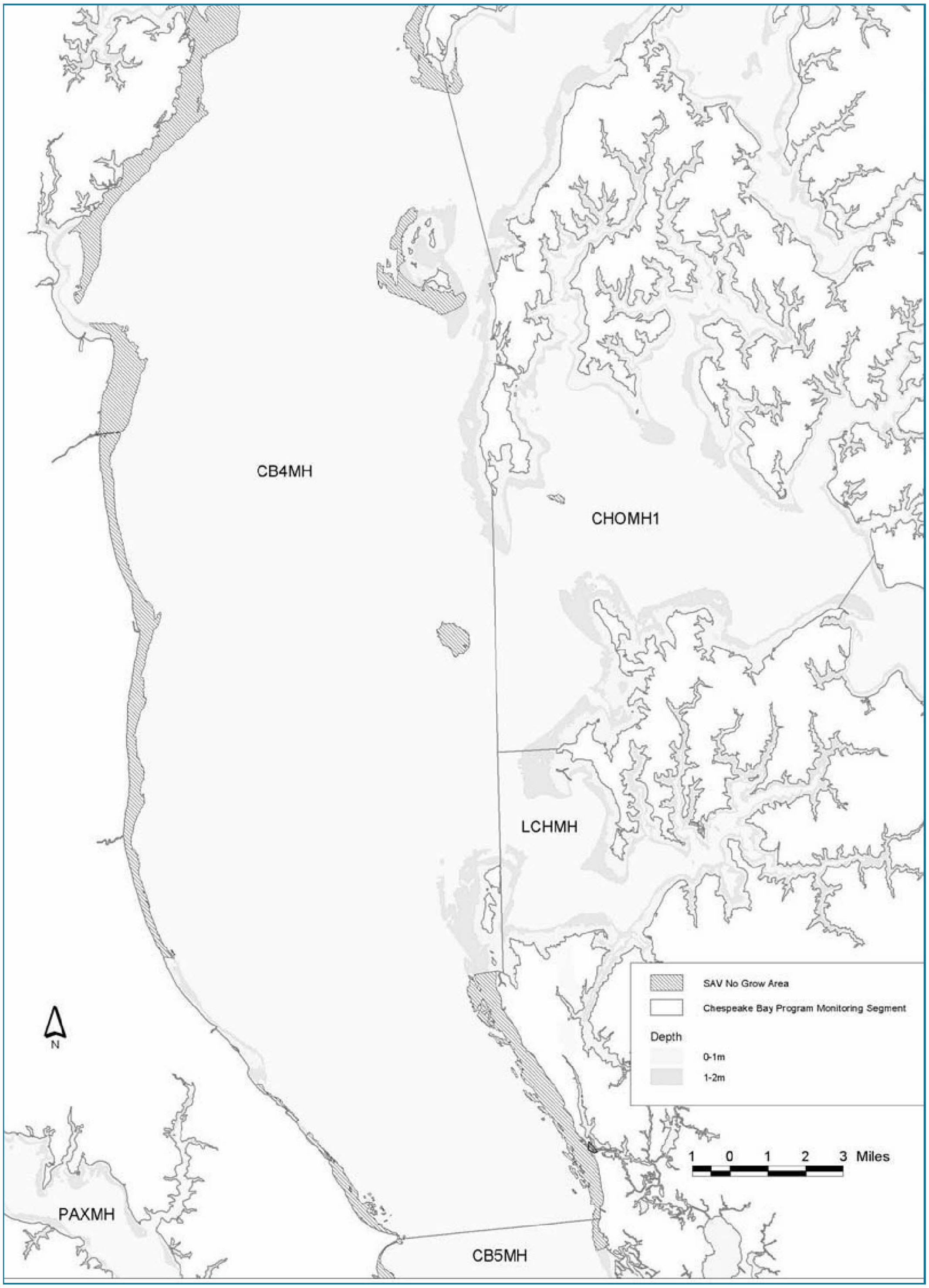

Figure V-5. Chesapeake Bay SAV no-grow zones for the lower section of the middle central Chesapeake Bay (CB4MH), mouth of the Choptank River (CHOMH1) and Little Choptank River (LCHMH).

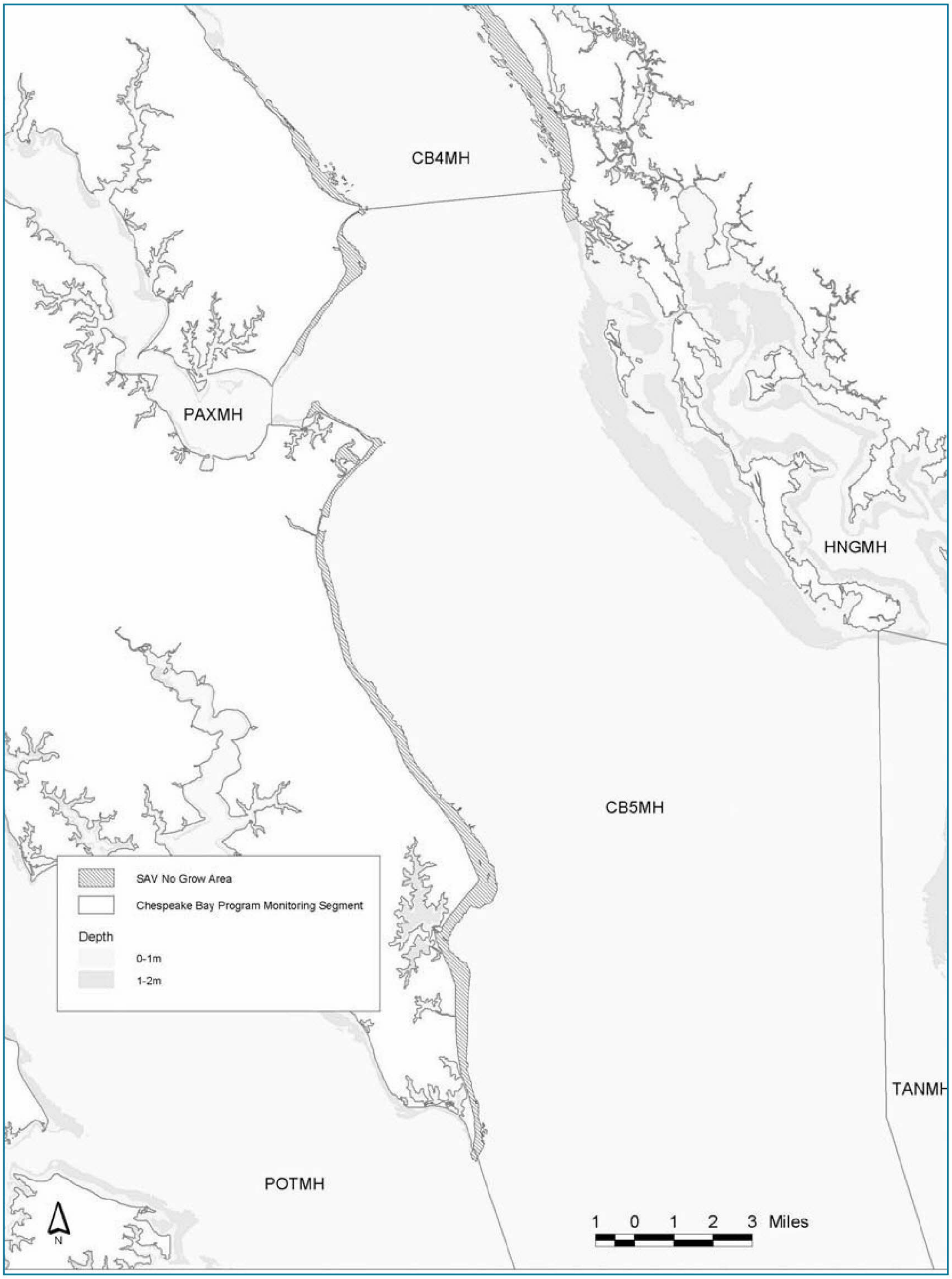

Figure V-6. Chesapeake Bay SAV no-grow zones for the upper section of the lower central Chesapeake Bay (CB5MH) and lower Potomac River (POTMH).

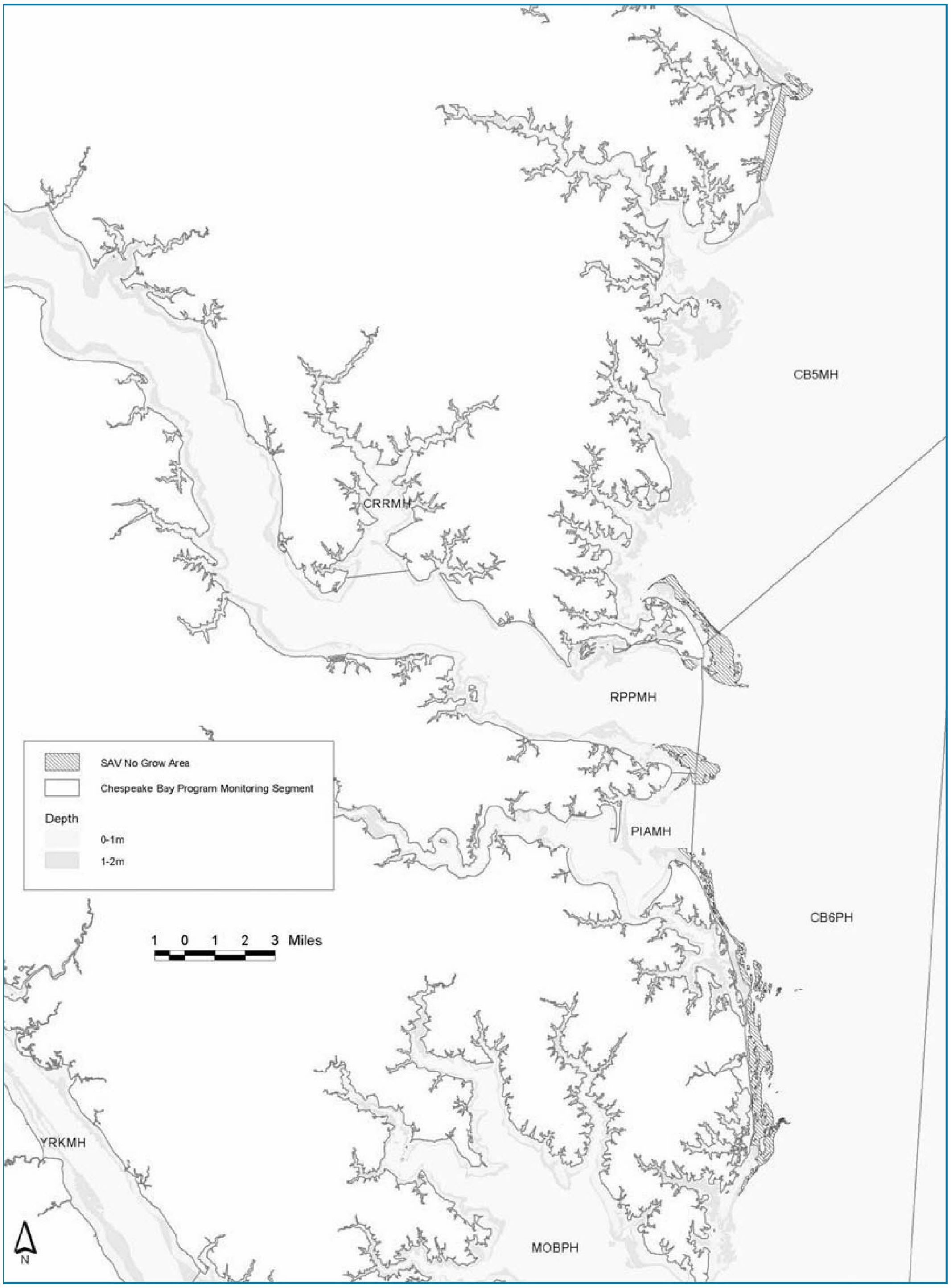

Figure V-7. Chesapeake Bay SAV no-grow zones for the lower section of the lower central Chesapeake Bay (CB5MH), upper section of the western lower Chesapeake Bay (CB6PH), lower Rappahannock River (RPPMH) and Piankatank River (PIAMH).

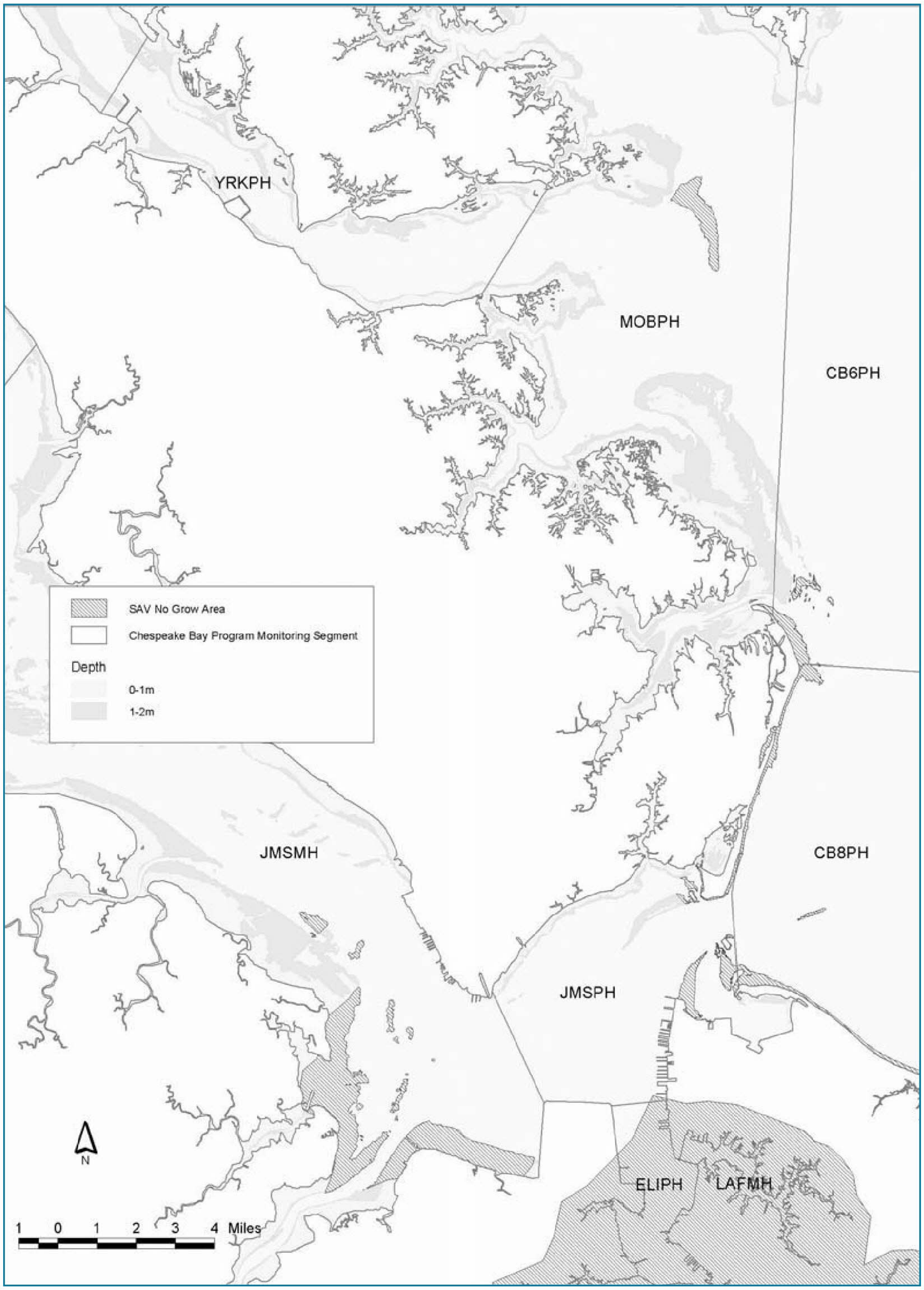

Figure V-8. Chesapeake Bay SAV no-grow zones for the lower section of the western lower Chesapeake Bay (CB6PH), Mobjack Bay (MOBPH), lower James River (JMSMH), mouth of the James River (JMSPH), mouth of the Elizabeth River (ELIPH), and Lafayette River (LAFMH).

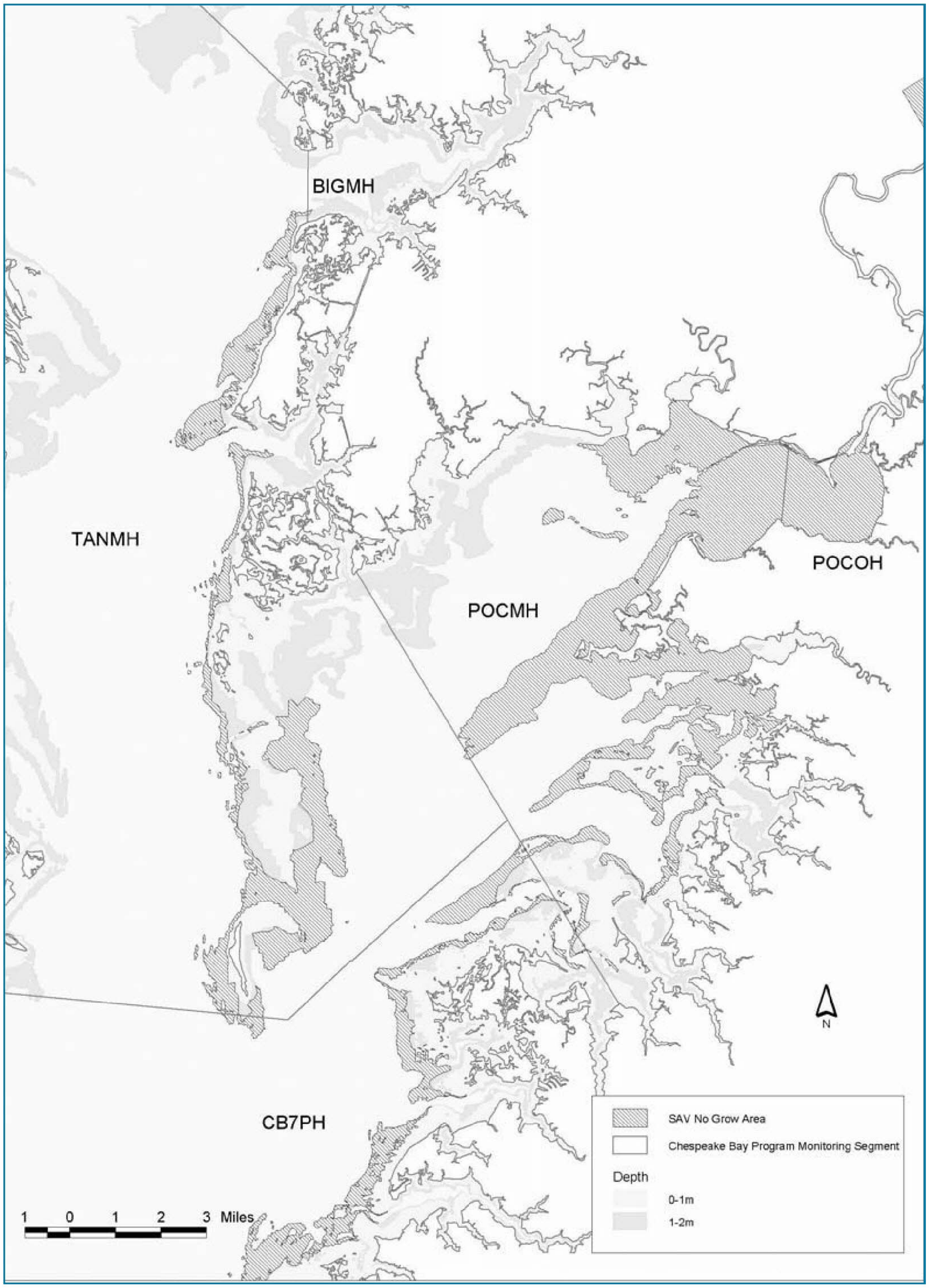

Figure V-9. Chesapeake Bay SAV no-grow zones for the Tangier Sound (TANMH), lower Pocomoke River (POCMH), middle Pocomoke River (POCOH), and the upper section of the eastern lower Chesapeake Bay (CB7PH).

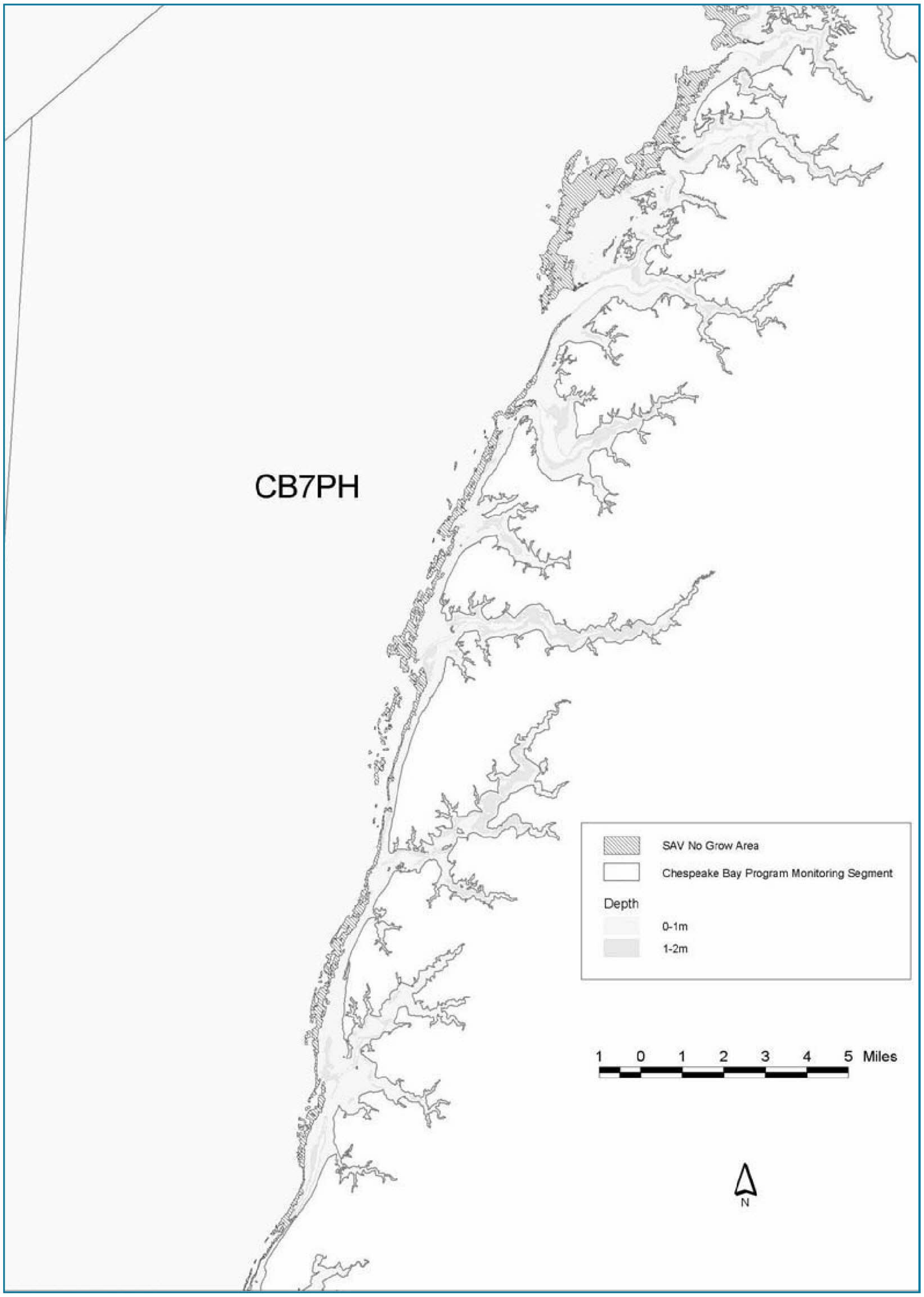

Figure V-10. Chesapeake Bay SAV no-grow zones for the middle section of the eastern lower Chesapeake Bay (CB7PH).

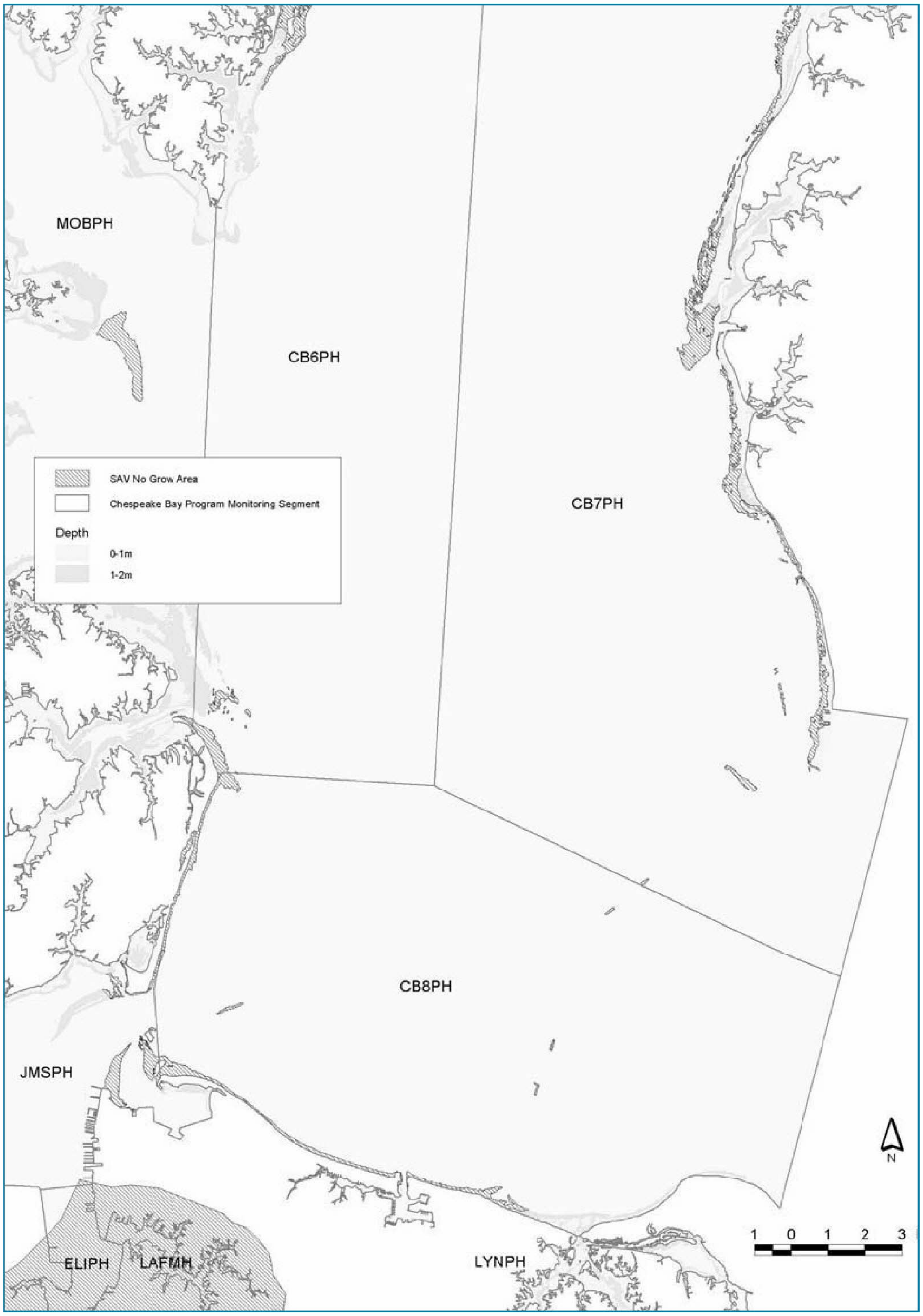

Figure V-11. Chesapeake Bay SAV no-grow zones for the lower section of the eastern lower Chesapeake Bay (CB7PH) and the mouth of the Chesapeake Bay (CB8PH).

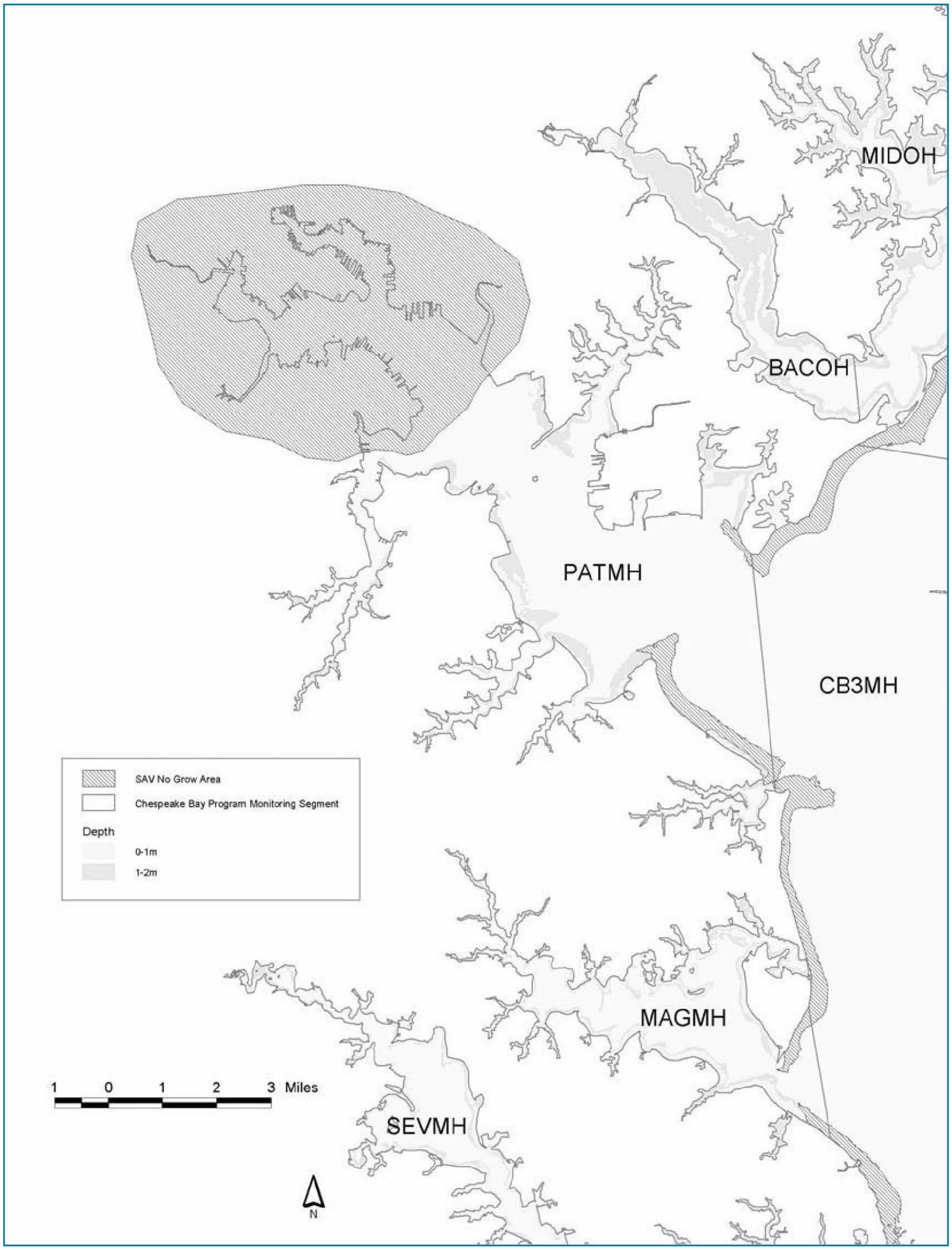

Figure V-12. Chesapeake Bay SAV no-grow zones for the Patapsco (PATMH) and Magothy (MAGMH) rivers.

chapter vi

Chesapeake Bay SAV Restoration Goal and Shallow Water Acreages

Updated and Expanded Documentation

Since the publication of the *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability* (U.S. EPA 2003), additional information has been generated and documented in support of state adoption of SAV restoration goal, shallow water habitat and shallow-water existing use acreages into their water quality standards regulations.

CHESAPEAKE SAV RESTORATION GOAL

CLIPPING OF 'ON LAND' SAV BEDS

The SAV restoration goal methodology to determine the single best year of SAV growth and subsequently set restoration goal acreages called for clipping mapped SAV beds to the shoreline used to delineate the Chesapeake Bay Program segments (U.S. EPA 2003). When the single best year maps of SAV beds were overlaid by the shoreline, parts of the mapped SAV beds looked as if they had been mapped on dry land. These 'on land' sections of SAV beds were clipped or removed from the acreage used to determine each respective segment's SAV restoration goal. The loss of this 'on land' SAV was due to inaccuracy in the shoreline data either because of the scale of the data, changes in the shoreline over time not being reflected in the data or some other factor. At the same time a similar problem involved SAV around islands. In some instances the shoreline data for islands were not very accurate or an island's actual shoreline had changed over time and so a similar SAV 'on land' effect and subsequent clipping of 'on land' SAV beds occurred.

CLIPPING OF SAV BEDS DUE TO LACK OF BATHYMETRY DATA

During the process of determining the SAV restoration goal, there were a limited number of areas of tidal waters completely lacking bathymetry data. In the absence of such data, those areas could not be considered in the single best year calculation and, therefore, in the quantification of the SAV restoration goal. The principal areas lacking bathymetry data included tidal portions of the upper Patuxent River (segment PAXTF) and Anacostia River (segment ANATF). While this lack of bathymetry data did not directly affect the Anacostia SAV restoration goal because no SAV had ever been recorded that far upstream, it greatly affected the upper Patuxent River restoration goal, excluding most of the mapped SAV that actually occurred in that segment. Also, there were no bathymetric data for many tidally connected ponds along the river and mainstem Bay shorelines and so SAV in these tidal ponds were also excluded from determination of the respective segment's SAV restoration goal.

CLIPPING OF SAV BEDS BY DEPTH

The maximum depth at which SAV beds were mapped was one of the key decision rules used in determining a Chesapeake Bay Program segment's water clarity application depth which, in turn, was used in setting the restoration goal acreage for that segment. The SAV restoration goal methodology called for clipping the single best year SAV acreage at the established water clarity criteria application depth. Even though mapped SAV beds extended beyond that established depth, these deeper SAV were eliminated from consideration in setting the SAV restoration goal.

The cumulative effect of these three forms of clipping was to undercount a segment's SAV acreage by the amount of SAV that went beyond the mapped shoreline, occurred in an area without bathymetric data and/or grew beyond the established water clarity criteria application depth.

ACCOUNTING FOR CLIPPED SAV ACREAGES

The baywide and segment specific Chesapeake Bay SAV restoration goals have been established and formally adopted by the Chesapeake Bay watershed partners (U.S. EPA 2003; Chesapeake Executive Council 2003). The acreage information reported here is intended to provide the jurisdictions with best accounting of SAV and shallow water acreages possible in a form directly comparable with SAV acreages reported through the annual baywide SAV aerial survey.

The chosen solution to addressing the above described undercounting problems was to count all of the SAV acreage for a given segment that occurred within the single best year regardless of any shoreline, bathymetry data limitations or water clarity application depth restrictions. In order words, evaluate the single best year SAV acreages without any artificial clipping. The advantage of this approach is that direct comparisons can be made with the SAV acreage mapped based on aerial photography gathered and interpreted through the annual baywide SAV aerial survey program. The SAV acreages reported through the aerial survey program by the Virginia Institute of Marine Science are reported as mapped (e.g., no clipping).

SHALLOW-WATER EXISTING USE ACREAGES

The shallow-water existing use acreages, reported in Table IV-15 on pages 124–127 of the *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability* (U.S. EPA 2003), were determined using part of the same methodology used to determine the SAV restoration goal acreages. The segment specific SAV restoration goals were derived from the full record of mapped SAV data (from historical through year 2000 data) for the year in which a segment had the greatest amount of SAV acreage, referred to as the single best year. The SAV data were then clipped by the shoreline used to define the segments (any data not within a segment boundary was deleted) and further clipped by the segment's water clarity criteria application depth, as described above. The existing use acreage methodology used the same single best year approach, except only mapped SAV data from 1978 through 2000 were considered. The resultant single best year acreage for each segment was then clipped by shoreline, but not by the water clarity criteria application depth.

To provide the jurisdictions with responsibilities for adopting state water quality standards regulations for Chesapeake Bay tidal waters with the best available quantification of existing use conditions, the data used for determination of the shallow-water existing use acreages has been expanded to include both 2001 and 2002 SAV data. In addition, the single best year SAV acreages were not clipped by the segment's shoreline. The addition of two more years of SAV data and not clipping by the shoreline resulted in increasing the existing use acreage for 25 of 78 total Chesapeake Bay Program segments compared to the existing use acreages originally published in the *Technical Support Document* (U.S. EPA 2003).

There were four possible reasons for why the updated (1978–2002) and non-clipped existing use acreages were now greater than the Chesapeake Bay Program adopted SAV restoration goal acreages, with more then one reason applying in many segments:

1. The 2001 or 2002 SAV acreage more recently mapped for the segment was greater than the SAV restoration goal single best year acreage based on historical through 2000 data.

2. The segment's water clarity criteria application depth was less than 2 meters while the existing use acreage, unclipped by the water clarity criteria application depth, reflected SAV mapped at all depths within the segment.

3. The SAV restoration goal single best acreage was clipped to the shoreline while the updated existing use acreage was not.

4. Some segments had single best year SAV mapped at depths greater than 2 meters (although not in large amounts) which could slightly increase the updated existing use acreage compared to SAV restoration goal acreage, even for those segments with a 2-meter application depth.

UPDATED RESTORATION, EXISTING USE AND SHALLOW-WATER ACREAGES

The four tables which follow provide the updated and expanded acreage data for appropriate use and application by the jurisdictions and partners accounting for the above described undercounting of actual mapped SAV. Table VI-1 lists the 'expanded restoration acreage' for each Chesapeake Bay Program segment and sorted by jurisdiction. Table VI-2 provides the same categories of data for the subset of split segments in Maryland and Virginia. The 'expanded restoration acreage' is the greatest acreage from among the updated existing use acreage (1978–2002; no shoreline clipping), the Chesapeake Bay Program adopted SAV restoration acreage (strictly adhering to adopted single best year methodology with clipping) and the goal acreage displayed without shoreline or application depth clipping and including SAV from areas still lacking bathymetry data. This 'expanded restoration acreage' is being documented here and provided to the partners as the best acreage value that can be directly compared with SAV acreages reported through the baywide SAV aerial survey. These acreages are not the officially adopted goals of the watershed partners; they are for consideration by the jurisdictions when adopting refined and new state water quality standards regulations for Chesapeake Bay tidal waters.

Table VI-3 illustrates the 'expanded restoration acreage' as a percentage of the shallow-water habitat acreage. The shallow-water habitat acreage is the portion of a Chesapeake Bay Program segment that is 0–2 meters in depth, excluding those areas designated as SAV no-grow zones. Note that there is no shallow-water habitat acreage value for the Patuxent River (segment PAXTF) because no bathymetry currently exists for most of the segment.

Table VI-4 is an updated version of Table IV-16 originally published in the *Technical Support Document* (U.S. EPA 2003). In this updated table, the 'expanded restoration acreage' is expressed as a percentage of the shallow-water habitat acreage and then summarized by salinity regime. The values presented in Table VI-4 do not include data from the upper Patuxent River for the reason referenced above.

Table VI-1. Updated shallow-water existing use acreage, Chesapeake Bay Program adopted SAV restoration goal, SAV restoration goal acreage without clipping and expanded SAV restoration acreage by Chesapeake Bay Program segment by jurisdiction.

Chesapeake Bay Program Segment Name	Chesapeake Bay Program Segment	Shallow-Water Existing Use Acreage (1978–2002 Single Best)	Year	Chesapeake Bay Program Adopted SAV Restoration Goal Acreage	Year	SAV Restoration Goal Acreage w/o Clipping and Depth Limitations	Expanded SAV Restoration Acreage
MARYLAND							
Northern Chesapeake Bay	CB1TF	9,223	2002	12,908	Historical	13,228	13,228
Upper Chesapeake Bay	CB2OH	705	2000	302	Historical	1,010	1,010
Upper Central Chesapeake Bay	CB3MH	1,370	1978	943	1978	1,370	1,370
Middle Central Chesapeake Bay	CB4MH	269	2002	2,511	Historical	2,824	2,824
Lower Central Chesapeake Bay	CB5MH #	2,136	2002	8,257	Historical	8,575	8,575
Bush River	BSHOH	350	2002	158	Historical	236	350
Gunpowder River	GUNOH	2,432	2000	2,254	2000	2,432	2,432
Middle River	MIDOH	740	2000	838	Historical	911	911
Back River	BACOH	*		*		*	*
Patapsco River	PATMH	121	1978	298	Historical	585	585
Magothy River	MAGMH	473	1979	545	Historical	716	716
Severn River	SEVMH	455	1999	329	1999	455	455
South River	SOUMH	54	1998	459	Historical	552	552
Rhode River	RHDMH	15	1978	48	Historical	98	98
West River	WSTMH	115	1978	214	Historical	338	338
Upper Patuxent River	PAXTF	205	2001	5	1996	158	205
Western Branch (Patuxent River)	WBRTF	*		*		*	*
Middle Patuxent River	PAXOH	115	2000	68	2000	115	115
Lower Patuxent River	PAXMH	141	2002	1,325	Historical	1,685	1,685
Upper Potomac River	POTTF #	2,142	1991	1,992	1991	2,142	2,142
Piscataway Creek	PISTF	789	1987	783	1987	789	789
Mattawoman Creek	MATTF	792	2002	276	2000	331	792
Middle Potomac River	POTOH #	2,801	1998	2,576	1998	2,801	2,801
Lower Potomac River	POTMH #	2,438	2002	6,919	Historical	9,005	9,005
Northeast River	NORTF	76	2002	88	Historical	164	164
C&D Canal	C&DOH	7	2001	0	1978	2	7
Bohemia River	BOHOH	354	2001	97	2000	187	354
Elk River	ELKOH	2,034	2001	1,648	2000	1,710	2,034
Sassafras River	SASOH	1,169	2001	764	2000	960	1,169
Upper Chester River	CHSTF	*		*		*	*
Middle Chester River	CHSOH	*		63	Historical	117	117
Lower Chester River	CHSMH	2,601	1978	2,724	Historical	3,762	3,762
Eastern Bay	EASMH	4,953	1999	6,108	Historical	6,397	6,397
Upper Choptank River	CHOTF	*		*		*	*
Middle Choptank River	CHOOH	*		63	Historical	89	89
Lower Choptank River	CHOMH2	233	1978	1,499	Historical	2,020	2,020
Mouth of the Choptank River	CHOMH1	6,898	1997	8,044	Historical	8,721	8,721
Little Choptank River	LCHMH	2,904	2002	3,950	Historical	4,134	4,134
Honga River	HNGMH	6,317	2002	7,686	Historical	7,935	7,935
Fishing Bay	FSBMH	109	2002	193	Historical	730	730
Upper Nanticoke River	NANTF #	*		*		*	*
Middle Nanticoke River	NANOH	*		3	Historical	13	13
Lower Nanticoke River	NANMH	*		3	Historical	6	6
Wicomico River	WICMH	*		3	Historical	8	8
Manokin River	MANMH	727	2002	4,359	Historical	4,434	4,434
Big Annemessex River	BIGMH	782	2002	2,014	Historical	2,212	2,212
Upper Pocomoke River	POCTF	*		*		*	*
Middle Pocomoke River	POCOH	*		*		*	*
Lower Pocomoke River	POCMH #	68	1993	859	Historical	912	912
Tangier Sound	TANMH #	9,134	1992	24,614	Historical	26,416	26,416
Totals		**66,247**		**108,790**		**121,282**	**122,610**

Table VI-1 continued. Updated shallow-water existing use acreage, Chesapeake Bay Program adopted SAV restoration goal, SAV restoration goal acreage without clipping and expanded SAV restoration acreage by Chesapeake Bay Program segment by jurisdiction.

Chesapeake Bay Program Segment Name	Chesapeake Bay Program Segment	Shallow-Water Existing Use Acreage (1978–2002 Single Best)	Year	Chesapeake Bay Program Adopted SAV Restoration Goal Acreage	Year	SAV Restoration Goal Acreage w/o Clipping and Depth Limitations	Expanded SAV Restoration Acreage
DISTRICT OF COLUMBIA							
Upper Potomac River	POTTF #	383	1991	368	1991	383	383
Anacostia River	ANATF	15	1996	6	1991	12	15
Totals		**398**		**374**		**395**	**398**
DELAWARE							
Upper Nanticoke River	NANTF #	*		*		*	*
VIRGINIA							
Lower Central Chesapeake Bay	CB5MH #	2,767	2002	6,704	Historical	7,633	7,633
Western Lower Chesapeake Bay	CB6PH	1,264	1993	980	Historical	1,267	1,267
Eastern Lower Chesapeake Bay	CB7PH	11,040	1993	14,620	Historical	15,107	15,107
Mouth of the Chesapeake Bay	CB8PH	11	1996	6	1996	11	11
Upper Potomac River	POTTF #	2,093	1991	2,008	1991	2,093	2,093
Middle Potomac River	POTOH #	1,503	1998	1,145	1998	1,503	1,503
Lower Potomac River	POTMH #	179	2002	3,254	Historical	4,250	4,250
Upper Rappahannock River	RPPTF	66	2001	20	2000	40	66
Middle Rappahannock River	RPPOH	*		*		*	*
Lower Rappahannock River	RPPMH	1,006	2002	5,380	Historical	7,814	7,814
Corrotoman River	CRRMH	768	2002	516	Historical	647	768
Piankatank River	PIAMH	1,075	1993	3,256	Historical	3,479	3,479
Upper Mattaponi River	MPNTF	85	1998	75	1998	85	85
Lower Mattaponi River	MPNOH	*	`	*		*	*
Upper Pamunkey River	PMKTF	187	1998	155	1998	187	187
Lower Pamunkey River	PMKOH	*		*		*	*
Middle York River	YRKMH	*		176	Historical	239	239
Lower York River	YRKPH	921	2002	2,272	Historical	2,793	2,793
Mobjack Bay	MOBPH	10,973	1997	15,096	Historical	15,901	15,901
Upper James River	JMSTF	95	2001	1,600	Historical	1,905	1,905
Appomattox River	APPTF	*		319	Historical	379	379
Middle James River	JMSOH	15	2001	7	1998	15	15
Chickahominy River	CHKOH	535	2000	348	2000	535	535
Lower James River	JMSMH	3	1999	531	Historical	712	712
Mouth of the James River	JMSPH	280	2002	604	Historical	693	693
Western Branch Elizabeth River	WBEMH	*		*		*	*
Southern Branch Elizabeth River	SBEMH	*		*		*	*
Eastern Branch Elizabeth River	EBEMH	*		*		*	*
Lafayette River	LAFMH	*		*		*	*
Mouth of the Elizabeth River	ELIPH	*		*		*	*
Lynnhaven River	LYNPH	107	1986	69	1986	107	107
Middle Pocomoke River	POCOH	*		*		*	*
Lower Pocomoke River	POCMH #	1,847	1993	3,233	Historical	4,066	4,066
Tangier Sound	TANMH #	8,972	1992	13,351	Historical	13,579	13,579
Totals		**45,792**		**75,725**		**85,039**	**85,186**
Totals for all jurisdictions		**112,437**		**184,889**		**206,716**	**208,194**

* No SAV data available or no SAV present.
# Contains only the jurisdiction's portion of the segment.

Table VI-2. Updated shallow-water existing use acreage, Chesapeake Bay Program adopted SAV restoration goal acreage, SAV restoration goal acreage without clipping, expanded SAV restoration and shallow-water acreage to the 2 meter depth for the split Chesapeake Bay Program segments in Maryland and Virginia.

Chesapeake Bay Program Segment Name	Chesapeake Bay Program Segment	Split Segment	Shallow-water Existing Use Acreage (1978 2002 Single Best Year)	Year	Chesapeake Bay Goal Adopted SAV Restoration Goal Acreage	Year	SAV Restoration Goal Acreage w/o Clipping and Depth Limitations	Year	Expanded SAV Restoration Acreage	Shallow-water Acreage to 2 meter Depth (Excluding SAV No-grow Zones)
MARYLAND										
Northern Chesapeake Bay	CB1TF	CB1TF1	639	2002	833	Historical	874	Historical	874	3,088
		CB1TF2	8,584	2002	12,075	Historical	12,354	Historical	12,354	17,820
Gunpowder River	GUNOH	GUNOH1	1,860	2000	1,772	2000	1,860	2000	1,860	3,540
		GUNOH2	572	2000	482	2000	572	2000	572	3,819
Lower Patuxent River	PAXMH	PAXMH1	138	2002	1,148	Historical	1,474	Historical	1,474	5,497
		PAXMH2	0	2002	172	Historical	201	Historical	201	2,206
		PAXMH3	0	2002	0	Historical	0	Historical	0	282
		PAXMH4	0	2002	2	Historical	3	Historical	3	348
		PAXMH5	3	2002	3	Historical	7	Historical	7	378
		PAXMH6	0	2002	0	Historical	0	Historical	0	82
Middle Potomac River	POTOH	POTOH1	1,387	1998	1,306	1998	1,387	1998	1,387	6,577
		POTOH2	262	1998	226	1998	262	1998	262	1,079
		POTOH3	1,153	1998	1,044	1998	1,153	1998	1,153	2,687
Elk River	ELKOH	ELKOH1	1,844	2001	1,593	2000	1,652	2000	1,844	3,648
		ELKOH2	190	2001	55	2000	57	2000	190	1,377
Sassafras River	SASOH	SASOH1	1,073	2001	763	2000	958	2000	1,073	1,772
		SASOH2	95	2001	1	2000	2	2000	95	1,938
Tangier Sound	TANMH	TANMH1	9,134	1992	24,451	Historical	26,250	Historical	26,250	43,558
		TANMH2	0	1992	164	Historical	166	Historical	166	4,251
Manokin River	MANMH	MANMH1	723	2002	4,264	Historical	4,331	Historical	4,331	8,615
		MANMH2	4	2002	95	Historical	103	Historical	103	2,085
Big Annamessex River	BIGMH	BIGMH1	780	2002	1,991	Historical	2,187	Historical	2,187	4,302
		BIGMH2	2	2002	23	Historical	25	Historical	25	763
VIRGINIA										
Upper James	JMSTF	JMSTF1	95	2001	1,333	Historical	1,530	Historical	1,530	9,947
		JMSTF2	0	2001	266	Historical	375	Historical	375	2,888

Table VI-3. Expanded SAV restoration acreage as percentage of available shallow-water habitat by Chesapeake Bay Program segment by jurisdiction.

Chesapeake Bay Program Segment Name	Chesapeake Bay Program Segment	Expanded SAV Restoration Acreage	Shallow-water Acreage to 2 meter Depth (Excluding SAV No-growth Zones)	Percent Expanded SAV Restoration Acreage of Shallow-water Habitat
MARYLAND				
Northern Chesapeake Bay	CB1TF	13,228	20,907	63.3
Upper Chesapeake Bay	CB2OH	1,010	8,787	11.5
Upper Central Chesapeake Bay	CB3MH	1,370	4,671	29.3
Middle Central Chesapeake Bay	CB4MH	2,824	10,630	26.6
Lower Central Chesapeake Bay	CB5MH #	8,575	15,586	55.0
Bush River	BSHOH	350	4,605	7.6
Gunpowder River	GUNOH	2,432	7,358	33.1
Middle River	MIDOH	911	2,479	36.7
Back River	BACOH	*	2,859	*
Patapsco River	PATMH	585	3,418	17.1
Magothy River	MAGMH	716	2,055	34.8
Severn River	SEVMH	455	2,108	21.6
South River	SOUMH	552	2,236	24.7
Rhode River	RHDMH	98	710	13.8
West River	WSTMH	338	1,468	23.0
Upper Patuxent River	PAXTF	205	–	–
Western Branch (Patuxent River)	WBRTF	*	0	*
Middle Patuxent River	PAXOH	115	2,072	5.6
Lower Patuxent River	PAXMH	1,685	8,793	19.2
Upper Potomac River	POTTF #	2,142	5,958	36.0
Piscataway Creek	PISTF	789	914	86.3
Mattawoman Creek	MATTF	792	1,389	57.0
Middle Potomac River	POTOH #	2,801	10,342	27.1
Lower Potomac River	POTMH #	9,005	32,323	27.9
Northeast River	NORTF	164	2,742	6.0
C&D Canal	C&DOH	7	171	4.1
Bohemia River	BOHOH	354	1,904	18.6
Elk River	ELKOH	2,034	5,024	40.5
Sassafras River	SASOH	1,169	3,710	31.5
Upper Chester River	CHSTF	*	870	*
Middle Chester River	CHSOH	117	2,308	5.1
Lower Chester River	CHSMH	3,762	11,500	32.7
Eastern Bay	EASMH	6,397	20,805	30.7
Upper Choptank River	CHOTF	*	0	*
Middle Choptank River	CHOOH	89	1,284	6.9
Lower Choptank River	CHOMH2	2,020	6,833	29.6
Mouth of the Choptank River	CHOMH1	8,721	20,857	41.8
Little Choptank River	LCHMH	4,134	12,368	33.4
Honga River	HNGMH	7,935	16,456	48.2
Fishing Bay	FSBMH	730	13,643	5.3
Upper Nanticoke River	NANTF #	*	0	*
Middle Nanticoke River	NANOH	13	2,053	0.6
Lower Nanticoke River	NANMH	6	7,712	0.1
Wicomico River	WICMH	8	5,911	0.1
Manokin River	MANMH	4,434	10,700	41.4
Big Annemessex River	BIGMH	2,212	5,065	43.7
Upper Pocomoke River	POCTF	*	0	*
Middle Pocomoke River	POCOH #	*	242	*
Lower Pocomoke River	POCMH #	912	5,049	18.1
Tangier Sound	TANMH #	26,416	47,809	55.3
Totals		**122,610**	**356,733**	
DISTRICT OF COLUMBIA				
Upper Potomac River	POTTF #	383	1,466	26.1
Anacostia River	ANATF	15	321	4.7
Totals		**398**	**1,787**	

Table VI-3 continued. Expanded SAV restoration acreage as percentage of available shallow-water habitat by Chesapeake Bay Program segment by jurisdiction.

Chesapeake Bay Program Segment Name	Chesapeake Bay Program Segment	Expanded SAV Restoration Acreage	Shallow-water Acreage to 2 meter Depth (Excluding SAV No-growth Zones)	Percent Expanded SAV Restoration Acreage of Shallow-water Habitat
DELAWARE				
Upper Nanticoke River	NANTF #	*	0	*
VIRGINIA				
Lower Central Chesapeake Bay	CB5MH #	7,633	14,514	52.6
Western Lower Chesapeake Bay	CB6PH	1,267	5,569	22.7
Eastern Lower Chesapeake Bay	CB7PH	15,107	34,085	44.3
Mouth of the Chesapeake Bay	CB8PH	11	1,050	1.0
Upper Potomac River	POTTF #	2,093	10,078	20.8
Middle Potomac River	POTOH #	1,503	4,851	31.0
Lower Potomac River	POTMH #	4,250	13,481	31.5
Upper Rappahannock River	RPPTF	66	4,512	1.5
Middle Rappahannock River	RPPOH	*	2,510	*
Lower Rappahannock River	RPPMH	7,814	30,108	26.0
Corrotoman River	CRRMH	768	2,611	29.4
Piankatank River	PIAMH	3,479	8,014	43.4
Upper Mattaponi River	MPNTF	85	1,409	6.0
Lower Mattaponi River	MPNOH	*	554	*
Upper Pamunkey River	PMKTF	187	2,652	7.1
Lower Pamunkey River	PMKOH	*	806	*
Middle York River	YRKMH	239	12,715	1.9
Lower York River	YRKPH	2,793	6,998	39.9
Mobjack Bay	MOBPH	15,901	33,990	46.8
Upper James River	JMSTF	1,905	12,835	14.8
Appomattox River	APPTF	379	1,603	23.7
Middle James River	JMSOH	15	10,944	0.1
Chickahominy River	CHKOH	535	4,501	11.9
Lower James River	JMSMH	712	26,598	2.7
Mouth of the James River	JMSPH	693	2,402	28.9
Western Branch Elizabeth River	WBEMH	*	*	*
Southern Branch Elizabeth River	SBEMH	*	*	*
Eastern Branch Elizabeth River	EBEMH	*	*	*
Lafayette River	LAFMH	*	*	*
Mouth of the Elizabeth River	ELIPH	*	*	*
Lynnhaven River	LYNPH	107	3,941	2.7
Middle Pocomoke River	POCOH #	*	*	*
Lower Pocomoke River	POCMH #	4,066	9,368	43.4
Tangier Sound	TANMH #	13,579	22,064	61.5
Totals		**85,186**	**284,758**	
Totals all jurisdictions		**208,194**	**643,278**	

* No SAV data available or no SAV present.
# Contains only the jurisdiction's portion of the segment.
– Insufficient bathymetry data available.

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Table VI-4. The expanded SAV goal acreage as a percentage of available shallow-water habitat by summarized salinity regime.

	Tidal-Fresh	Oligohaline	Mesohaline	Polyhaline
All segments in regime	33.1	17.0	33.4	40.8
Minimum (single segment)	0	0	0.1	1.0
Maximum (single segment)	86.3	40.5	61.5	46.8
Number of segments*	13	20	29	7

*Segments totally within exclusion areas not included.

UPPER TIDAL POTOMAC RIVER WATER CLARITY CRITERIA APPLICATION DEPTHS

As part of the efforts described previously in Chapter 4 for delineating the boundaries between the three jurisdictions with tidal Potomac waters, the SAV restoration goal acreage for the upper Potomac River segment POTTF was divided into separate SAV acreage goals for Maryland, Virginia and the District of Columbia (Table VI-1). However, a segment-wide existing use acreage and single water clarity criteria application depth remained. The jurisdictions requested a recalculation of the applicable existing use acreage and the water clarity application depth specific to their portion of the upper Potomac River segment.

Following the decision rules previously published in the *Technical Support Document* (U.S. EPA 2003), EPA determined the existing use acreage and the water clarity criteria application depth necessary to restore the SAV restoration goal acreage specific to each jurisdiction's portion of the upper Potomac River segment (POTTF). The resultant jurisdiction specific existing use acreages are presented in Table VI-1. The Maryland portion of segment POTTF required a 2 meter water clarity criteria application depth to both protect existing uses as well as to meet the SAV restoration goal whereas the Virginia and District of Columbia portions of the same segment required at least a 1 meter application depth. This analysis supports the three jurisdictions sharing the tidal waters of the upper Potomac River segment POTTF applying different shallow water designated use applications depths for their water clarity criteria to protect existing uses and support achievement of the SAV restoration goal for their portions of the shallow waters within this segment.

appendix a

Chesapeake Bay and Tidal Tributaries Designated Use Boundary Documentation

Table A-1. Narrative descriptions and latitude/longitude coordinates for the Chesapeake Bay migratory spawning and nursery designated use boundaries.

River or Bay and all tributaries from the following points upstream	State(s)		Latitude	Longitude	Description
Upper Chesapeake Bay	MD	Point 1	39.011570	-76.394485	Sandy Point, Sandy Point SP
		Point 2	38.994961	-76.324997	Kent Island, 1 mile north of Bay Bridge
Severn River	MD	Point 1	38.981407	-76.476166	USNA, eastern corner of seawalls, north of Spa Creek
		Point 2	38.983685	-76.471535	0.13 miles NW of US Naval Reservation boat basin
South River	MD	Point 1	38.898491	-76.493752	Shoreham Beach, south end
		Point 2	38.915867	-76.477776	One third mile SE of Cherrytree Cove, west of Oakwoo
Rhode River	MD	Point 1	38.880882	-76.522644	Locust Point
		Point 2	38.879383	-76.514511	Cloverlea, at mouth of Cadle Creek
West River	MD	Point 1	38.850563	-76.518219	East side of mouth of Deadwood Cove
		Point 2	38.862885	-76.533806	West side of mouth of Scaffold Creek
Patuxent River	MD	Point 1	38.323620	-76.494446	Mouth of Little Kingston Creek
		Point 2	38.130527	-76.433563	West side of Point Patience. 0.1 mile from the tip
Potomac River	MD/VA/DC	Point 1	38.168564	-76.856857	0.2 miles NW of Big Meadow Run, Westmoreland SP
		Point 2	38.256958	-76.805122	West side of Whites Neck, NE of St. Margaret Island
St. Clements Bay	MD	Point 1	38.226414	-76.747932	Coltons Pt.
		Point 2	38.233227	-76.719238	Cornish Pt.
Breton Bay	MD	Point 1	38.234688	-76.704155	Kaywood Pt.
		Point 2	38.233093	-76.686234	Huggins Pt.
St. Marys River	MD	Point 1	38.133293	-76.461433	0.4 miles south of Edmund Pt.
		Point 2	38.130527	-76.433563	W side Inigoes Neck, 0.6 miles SSW of Fort Pt.
Rappahannock River	VA	Point 1	37.786079	-76.715286	0.7 miles dowmstream of Mark Haven Beach
		Point 2	37.823021	-76.701874	Sharps
York River	VA	Point 1	37.435936	-76.737389	Mt. Folly, 0.55 miles SE of Sycamore Landing
		Point 2	37.448486	-76.715416	0.6 miles upstream of mouth of Poropotank Bay

Table A-1 continued. Narrative descriptions and latitude/longitude coordinates for the Chesapeake Bay migratory spawning and nursery designated use boundaries.

River or Bay and all tributaries from the following points upstream	State(s)		Latitude	Longitude	Description
James River	VA	Point 1	37.024994	-76.581276	1.2 miles downstream of Mogarts Beach
		Point 2	37.076099	-76.554527	Jail Pt.
Wye River	MD	Point 1	38.874359	-76.193619	East side of western neck of Wye I., south of Drum Pt.
		Point 2	38.859478	-76.190376	North end of Bruffs Island
Miles River	MD	Point 1	38.775665	-76.158585	0.33 miles east of Hunting Creek mouth
		Point 2	38.771210	-76.155998	0.95 miles NE of Newcomb Creek
Tred Avon River	MD	Point 1	38.708347	-76.149284	On SE point of neck containing Pecks Point Rd.
		Point 2	38.703396	-76.139626	At pond between Goldsborough Cr. and Trippe Cr.
Choptank River	MD	Point 1	38.614681	-76.081299	0.25 miles east of Dickinson Bay mouth
		Point 2	38.592419	-76.085014	Western end of Hambrooks Bar
Fishing Bay	MD	Point 1	38.292126	-76.036751	Little Creek Marsh, 1 mile NW of Roasting Ear Pt.
		Point 2	38.301033	-76.006828	McCreadys Pt.
Nanticoke River	MD	Point 1	38.343781	-75.908028	Northern end of Lower Greens Cove
		Point 2	38.326164	-75.884125	1200' SSW of northern tip of Hatcrown Pt.
Wicomico River (East)	MD	Point 1	38.247482	-75.851654	Holland Pt.
		Point 2	38.241608	-75.845528	0.2 miles upstream of Victor Pt.
Monie Bay	MD	Point 1	38.230408	-75.834694	0.64 miles west of Nail Pt.
		Point 2	38.212467	-75.841820	0.44 miles SW of Bay Pt.
Manokin River	MD	Point 1	38.148384	-75.825874	Between Geanquakin Creek and St. Peters Creek
		Point 2	38.133850	-75.814491	Halfway between Broad Creek and Fishing Pt.
Big Annemessex River	MD	Point 1	38.074532	-75.787209	Charles Pt.
		Point 2	38.070129	-75.778313	0.16 miles downstream of Gales Creek
Pocomoke River	MD	Point 1	37.970169	-75.646004	0.72 miles NE of northeeast tip of Fair Island
		Point 2	37.968102	-75.643646	0.3 miles north of SW tip of Pitts Neck

Table A-2. Narrative descriptions and lattitude/longitude coordinates for the Chesapeake Bay open-water, deep-water and deep-channel designated use boundaries.

Designated Use	Chesapeake Bay Program Segment Name	Chesapeake Bay Program Segment			Latitude/Longitude and Narrative Georeference Identifiers for End Coordinates Bounding Each Designated Use	
Deep Water						
Zone 1	Southern Branch Elizabeth River	SBEMH				
Zone 2	Lower York River	YRKPH				
Zone 3	* not defined by CBP segments				Northern part of lower Chesapeake Bay and lower Rappahannock River	
			Point 1	Lat/Long	37.445248	-76.251490
				Description	East side of Rigby I., 0.5 miles from southern end	
			Point 2	Lat/Long	37.446326	-76.142080
				Description	6 miles due east of Point 1	
			Point 3	Lat/Long	37.513095	-76.137665
				Description	8.1 miles due east of north end of Gwynn I. (Point 17)	
			Point 4	Lat/Long	37.782822	-75.800687
				Description	Big Marsh on Pompco Creek, north of Rogue I.	
			Point 5	Lat/Long	37.787926	-75.741074
				Description	S of Webb I., between Deep Cr. and Doe Cr.	
			Point 6	Lat/Long	37.846237	-75.786530
				Description	0.57 miles WSW of fl. red lt. at tip of Guilford Flats	
			Point 7	Lat/Long	37.781960	-75.873726
				Description	1 mile SE of S tip of Watts I., just E of quad bound.	
			Point 8	Lat/Long	37.797581	-76.025650
				Description	3 miles WNW of Tangier Sound Light	
			Point 9	Lat/Long	37.619465	-76.280251
				Description	Fleets Island, at end of road north of Windmill Pt.	
			Point 10	Lat/Long	37.613708	-76.280586
				Description	Windmill Pt.	
			Point 11	Lat/Long	37.653767	-76.457794
				Description	0.5 mile NW of Orchard Pt.	
			Point12	Lat/Long	37.649799	-76.496513
				Description	Aprox. 0.25 miles S of Whitehouse Cr. Mouth	
			Point 13	Lat/Long	37.642095	-76.509873
				Description	Towles Pt.	
			Point 14	Lat/Long	37.612686	-76.533853
				Description	North of Christchurch, 0.75 miles west of Cooper	
			Point 15	Lat/Long	37.558598	-76.297974
				Description	Stingray Pt.	
			Point 16	Lat/Long	37.558395	-76.283516
				Description	0.8 miles east of Stingray Pt. (RPPMH point 1)	
			Point 17	Lat/Long	37.512447	-76.285423
				Description	Gwynn Island, east side of northern end	
			Point 18	Lat/Long	37.473808	-76.263008
				Description	Gwynn Island, 0.25 miles NE of Sandy Pt. tip	
			Point 19	Lat/Long	37.462313	-76.257705
				Description	0.08 miles NNE from northern tip of Rigby I.	
			Point 20	Lat/Long	37.459854	-76.257225
				Description	Rigby Island, east side of northern end	
Deep Channel						
Zone 1	* not defined by CBP segments			Middle lower Rappahannock River		
			Point 1	Lat/Long	37.612686	-76.533853
				Description	North of Christchurch, 0.75 miles west of Cooper	
			Point 2	Lat/Long	37.642095	-76.509873
				Description	Towles Pt.	
			Point 3	Lat/Long	37.800789	-76.654432
				Description	Oakley Landing	
			Point 4	Lat/Long	37.799628	-76.734467
				Description	0.7 miles NW of Mark Haven Beach	
Zone 2	Upper Central Chesapeake Bay	CB3MH				
	Middle Central Chesapeake Bay	CB4MH				
	Lower Central Chesapeake Bay	CB5MH				
	Patapsco River	PATMH				
	Lower Patuxent River	PAXMH				
	Lower Potomac River	POTMH				
	Lower Chester river	CHSMH				
	Eastern Bay	EASMH				

appendix b

Maryland's and Virginia's Chesapeake Bay Program Split Segment Boundary Documentation

Table B-1. Latitude/longitude and narrative georeference identifiers for the end coordinates bounding each of Maryland's and Virginia's split Chesapeake Bay Program segments.

Coordinates bounding Maryland split segments

Segment Description		CBP Segment	Split Segment	Number of Latitude/ Longitude Coordinates to follow
MARYLAND				
Northern Chesapeake		CB1TF	CB1TF1	8
39.420143	-76.123344	1000' SW of Cherry Tree Pt., APG		
39.401688	-76.035194	North of Chesapeake Haven, Grove Neck		
39.429420	-75.997681	1300' SW of Wroth Pt.		
39.449200	-76.007698	Turkey Pt.		
39.449471	-76.010475	Turkey Pt., 0.1 miles WSW of lighthouse		
39.475323	-76.072807	Locust Pt. on Spesutie Island		
39.476006	-76.094421	East side of Spesutie Narrows bridge		
39.475132	-76.097580	West side of Spesutie Narrows bridge		
			CB1TF2	10
39.475132	-76.097580	West side of Spesutie Narrows bridge		
39.476006	-76.094421	East side of Spesutie Narrows bridge		
39.475323	-76.072807	Locust Pt. on Spesutie Island		
39.449471	-76.010475	Turkey Pt., 0.1 miles WSW of lighthouse		
39.529629	-75.979271	Red Pt.		
39.540794	-76.002899	East side of Carpenter Pt.		
39.608994	-76.121094	Port Deposit		
39.608959	-76.132683	East side Spencer Island		
39.609001	-76.135147	West side Spencer Island		
39.608971	-76.143379	Just south of Rock Run on western shore		

Segment Description		CBP Segment	Split Segment	Number of Latitude/ Longitude Coordinates to follow
MARYLAND (cont).				
Gunpowder River		GUNOH	GUNOH1	8
39.316414	-76.331039	Carroll I., midway betw. White Oak and Carroll Pts.		
39.312862	-76.321449	Carroll Pt.		
39.312767	-76.321190	Carroll Pt.		
39.303204	-76.296249	Rickett Pt. at end of Ricketts Pt. Rd.		
39.356564	-76.322929	Maxwell Pt.		
39.358330	-76.345024	Cunninghill Cove, mouth of unnamed creek		
39.326569	-76.361801	170' South of West side of bridge to Carroll Island		
39.326477	-76.361130	170' S of east side of bridge to Carroll Island		
			GUNOH2	3
39.358330	-76.345024	Cunninghill Cove, mouth of unnamed creek		
39.356564	-76.322929	Maxwell Pt.		
39.412685	-76.400780	Gunpowder Falls, 1500' below Rt. 7		
Lower Patuxent River		PAXMH	PAXMH1	12
38.304638	-76.421448	Fishing Pt.		
38.319176	-76.420990	Drum Pt.		
38.322941	-76.451630	Point of land S of Ship Pt. and E of Ma Leg I.		
38.321041	-76.451965	Eastern tip of Solomons		
38.386593	-76.498840	Mouth of St. Leonard Creek, east side		
38.389153	-76.506416	Petersons Pt.		
38.412220	-76.542747	Island Creek mouth, east Side		
38.411896	-76.544487	Island Creek mouth, Broomes Island Side		
38.481140	-76.647560	0.64 miles south of the Sandy Pt. near Buzzard I.		
38.475594	-76.662788	Trent Hall Pt.		
38.342590	-76.500587	Mouth of Cuckold Creek, north side		
38.339634	-76.499550	Mouth of Cuckold Creek, south side		
			PAXMH2	4
38.475594	-76.662788	Trent Hall Pt.		
38.481140	-76.647560	0.64 miles south of the Sandy Pt. near Buzzard I.		
38.540684	-76.668045	Gods Grace Pt. near end of Leitchs Wharf Rd.		
38.542320	-76.678818	Chalk Pt., eastern side		
			PAXMH3	2
38.321041	-76.451965	Eastern tip of Solomons		
38.322941	-76.451630	Point of land S of Ship Pt. and E of Ma Leg I.		
			PAXMH4	2
38.339634	-76.499550	Mouth of Cuckold Creek, south side		
38.342590	-76.500587	Mouth of Cuckold Creek, north side		
			PAXMH5	3
38.389153	-76.506416	Petersons Pt.		
38.386593	-76.498840	Mouth of St. Leonard Creek, east side		
38.446831	-76.492088	0.25 miles downstream of Parran Road		

Segment Description		CBP Segment	Split Segment	Number of Latitude/ Longitude Coordinates to follow
MARYLAND (cont).				
			PAXMH6	3
38.411896	-76.544487	Island Creek mouth, Broomes Island Side		
38.412220	-76.542747	Island Creek mouth, east Side		
38.433407	-76.540894	0.7 miles N of point where Marshall Rd. ends		
Middle Potomac River		POTOH	POTOH1	8
38.389660	-77.029305	1 mile SE of Mathias Pt., just north of 639		
38.407509	-76.997322	0.65 miles NW of the town of Popes Creek		
38.444935	-77.016396	1.5 miles SE of Chapel Pt., due E of Windmill Pt.		
38.444565	-77.040695	Windmill Pt.		
38.408894	-77.110886	Blossom Pt.		
38.408745	-77.124855	0.15 miles SW of Benny Gray Pt.		
38.523266	-77.256630	1000’ SW of Moss Pt.		
38.524181	-77.285294	Midway between Shipping Pt. and Quantico Pier		
			POTOH2	3
38.444565	-77.040695	Windmill Pt.		
38.444935	-77.016396	1.5 miles SE of Chapel Pt., due E of Windmill Pt.		
38.500164	-77.026306	Port Tobacco Marina (edge of 7.5’ quad sheet)		
			POTOH3	3
38.408745	-77.124855	0.15 miles SW of Benny Gray Pt.		
38.408894	-77.110886	Blossom Pt.		
38.475391	-77.130676	Wards Run, 0.25 miles upstream of Hill Top Fork		
Elk River		ELKOH	ELKOH1	8
39.449200	-76.007698	Turkey Pt.		
39.429420	-75.997681	1300’ SW of Wroth Pt.		
39.474773	-75.940498	East of Ford Landing on Veazey Neck		
39.486473	-75.923767	Town Pt.		
39.523182	-75.871521	West of where the road north from Randalia ends		
39.525536	-75.874619	East side of Welch Pt.		
39.544392	-75.855301	Paddy Biddle Cove		
39.545540	-75.876144	0.6 miles south of Elkmore		
			ELKOH2	3
39.545540	-75.876144	0.6 miles south of Elkmore		
39.544392	-75.855301	Paddy Biddle Cove		
39.607624	-75.822853	Elkton - 500’ below Rt. 7		
Sassafras River		SASOH	SASOH1	4
39.389511	-76.040848	Grove Pt.		
39.372025	-76.101227	2850’ east of Howells Pt.		
39.371868	-75.955750	0.66 miles NW of Freeman Creek		
39.378330	-75.961472	Cassidy Wharf		

Segment Description		CBP Segment	Split Segment	Number of Latitude/ Longitude Coordinates to follow
MARYLAND (cont.)				
			SASOH2	3
39.378330	-75.961472	Cassidy Wharf		
39.371868	-75.955750	0.66 miles NW of Freeman Creek		
39.376785	-75.806549	350' upstream of Rt. 301		
Tangier Sound		TANMH	TANMH1	26
37.792580	-76.032707	3.25 miles W, 0.3 miles N of Tangier Sound Light		
37.781960	-75.873726	1 mile SE of S tip of Watts I., just E of quad bound.		
37.846237	-75.786530	0.57 miles WSW of fl. red lt. at tip of Guilford Flats		
37.924927	-75.848007	Eastward Pt., on eastern side of Broad Creek		
38.015781	-75.845947	East side of Daugherty Creek Canal		
38.016033	-75.846458	West side of Daugherty Creek Canal		
38.020733	-75.856712	South side of gut SW of Acre Creek		
38.020973	-75.856819	North side of gut SW of Acre Creek		
38.036049	-75.868935	700' east of Flatcap Pt., Janes Island		
38.058910	-75.868744	South shore of Pat Island		
38.064907	-75.866974	NE Pat Island, across gut from Hazard Island		
38.065315	-75.866608	Hazard Island, across gut from Pat Island		
38.075314	-75.870750	Gut between Hazard Cove and Mine Cr., south side		
38.075665	-75.871155	Gut between Hazard Cove and Mine Cr., north side		
38.078552	-75.877586	Hazard Island, 1200' NE of tip of Hazard Pt.		
38.122917	-75.937126	Eastern side of Little Deal Island		
38.125946	-75.941216	Eastern point on north side of Little Deal Island		
38.131565	-75.948860	Wenona on Deal Island, north of channel		
38.136566	-75.959633	Twiggs Pt.		
38.232738	-75.972618	Southern-most point of Clay Island		
38.216042	-76.032051	Bishops Head Pt.		
38.215809	-76.032349	Bishops Head Pt.		
38.231964	-76.134285	Lower Hooper I. between Nancys and Creek Pts.		
38.231445	-76.135773	Lower Hooper I. between Nancys and Creek Pts.		
38.051910	-76.128838	7000' N and 2500' W of Fog Pt., Smith Island		
37.797581	-76.025650	3 miles WNW of Tangier Sound Light		
			TANMH2	8
38.232738	-75.972618	Southern-most point of Clay Island		
38.136566	-75.959633	Twiggs Pt.		
38.160080	-75.932388	Upper Thorofare, Deal Island side		
38.160442	-75.929558	Upper Thorofare at the mouth of Moores Gut		
38.202679	-75.890579	1100' west of the tip of Long Pt.		
38.227970	-75.893486	Nanticoke Pt. (Stump Point Marsh)		
38.243217	-75.906105	West of Waterview, north of Jones Creek		
38.244740	-75.941284	Sandy Island, NE of Frog Pt.		
Manokin River		MANMH	MANMH1	14
38.131565	-75.948860	Wenona on Deal Island, north of channel		
38.125946	-75.941216	Eastern point on north side of Little Deal Island		
38.122917	-75.937126	Eastern side of Little Deal Island		
38.078552	-75.877586	Hazard Island, 1200' NE of tip of Hazard Pt.		
38.075665	-75.871155	Gut between Hazard Cove and Mine Creek, N side		
38.075314	-75.870750	Gut between Hazard Cove and Mine Creek, S side		

Segment Description		CBP Segment	Split Segment	Number of Latitude/ Longitude Coordinates to follow
MARYLAND (cont.)				
38.069160	-75.855591	West part Hazard Island at Shirtpond Cove		
38.069599	-75.853897	East part Hazard Island at Shirtpond Cove		
38.073784	-75.848656	W side of gut heading N from Flatland Cove		
38.074146	-75.848228	E side of gut heading N from Flatland Cove		
38.133823	-75.827339	Cormal Pt.		
38.142979	-75.821144	Champ Pt.		
38.160442	-75.929558	Upper Thorofare at the mouth of Moores Gut		
38.160080	-75.932388	Upper Thorofare, Deal Island side		
			MANMH2	3
38.142979	-75.821144	Champ Pt.		
38.133823	-75.827339	Cormal Pt.		
38.172668	-75.732979	Manokin River confluence with Hall Branch		
Big Annamessex River		BIGMH	BIGMH1	14
38.058910	-75.868744	South shore of Pat Island		
38.036049	-75.868935	700' East of Flatcap Pt., Janes Island		
38.020973	-75.856819	North side of gut SW of Acre Creek		
38.020733	-75.856712	South side of gut SW of Acre Creek		
38.016033	-75.846458	West side of Daugherty Creek Canal		
38.015781	-75.845947	East side of Daugherty Creek Canal		
38.078850	-75.782249	Persimmon Pt.		
38.074585	-75.787170	Charles Pt.		
38.074146	-75.848228	East side of gut heading N from Flatland Cove		
38.073784	-75.848656	W side of gut heading N from Flatland Cove		
38.069599	-75.853897	East part Hazard Island at Shirtpond Cove		
38.069160	-75.855591	West part Hazard Island at Shirtpond Cove		
38.065315	-75.866608	Hazard Island, across gut from Pat Island		
38.064907	-75.866974	NE Pat Island, across gut from Hazard Island		
			BIGMH2	3
38.074585	-75.787170	Charles Pt.		
38.078850	-75.782249	Persimmon Pt.		
38.087246	-75.733032	1000' below confluence with Annemesex Creek		
VIRGINIA				
Upper James River		JMSTF	JMSTF1	6
37.227379	-76.946426	0.3 miles downstream of Sloop Pt.		
37.241180	-76.945686	Tettington, 500' downstream of road to the river		
37.332580	-77.267880	Most western point of Eppes Isand		
37.334998	-77.274640	South of Bermuda Hundred, west of substation		
37.329826	-77.281128	Mouth of sm. creek E of Shand Cr. and N of light		
37.317638	-77.277275	City Point, Hopewell		
			JMSTF2	3
37.334998	-77.274640	South of Bermuda Hundred, west of substation		
37.332580	-77.267880	Most western point of Eppes Isand		
37.533394	-77.436775	Upstream of Mayos Bridge, as far as Browns I. dam		